



Simultaneous Subtraction of MWD and SRME

NZ 3D Processing

03 February 2021

cgg.com



INSTITUTE FOR GEOPHYSICS



Passion for Geoscience

1. Convert to CGG internal format
2. Nav merge / trace edit
3. Low cut filter
4. Time Variant Scaling (TVS) & Resample to 4ms
5. Swell noise attenuation (SNA)
6. Debubble
7. Linear noise attenuation (LNA)
8. Tidal statics correction
9. Water column statics correction
10. Shot & channel scaling
11. Receiver motion correction (RMC)
12. Joint Deghost & Designature
13. Residual Bubble Removal
14. Source Sensor Datum Correction
15. Shallow Water Demultiple
16. Surface Related Multiple Elimination (3D SRME)
17. Simultaneous Subtraction of MWD & SRME

- **Objective:**

To remove free surface related multiple.

- **Procedure:**

Subtract MWD & SRME models from input seismic to achieve multiple free seismic data.

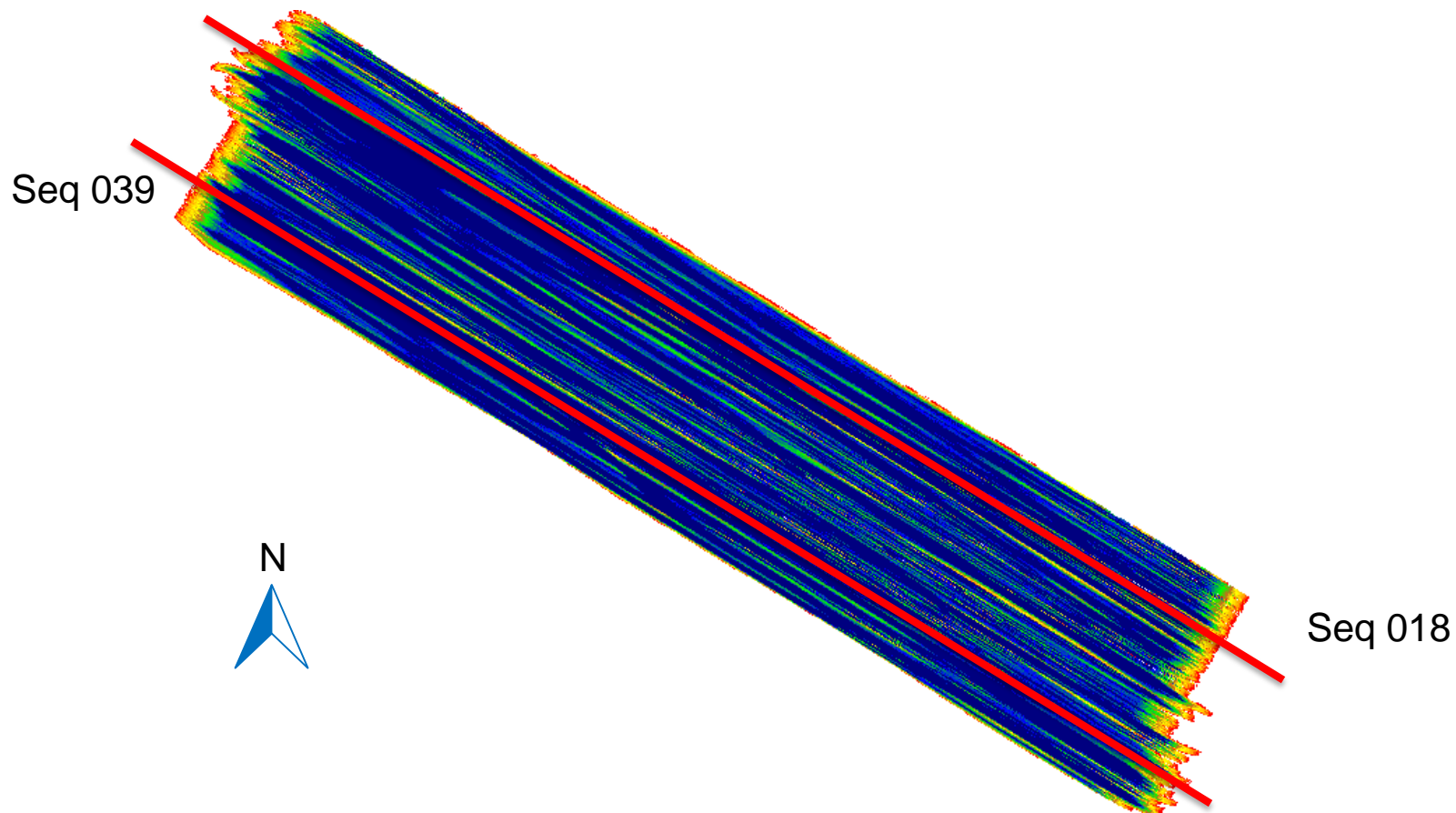
- **Display:**

Sailline 018, 039

Display: Stack, common channel and shot gathers.(Input; SRME Subtraction; SRME & MWD Subtraction; Difference from input; SRME & MWD Model)

- **Observation and Recommendation:**

Simultaneous subtraction with both MWD & SRME models shows benefit in multiple removal and primary protection. It's recommended to apply for production.



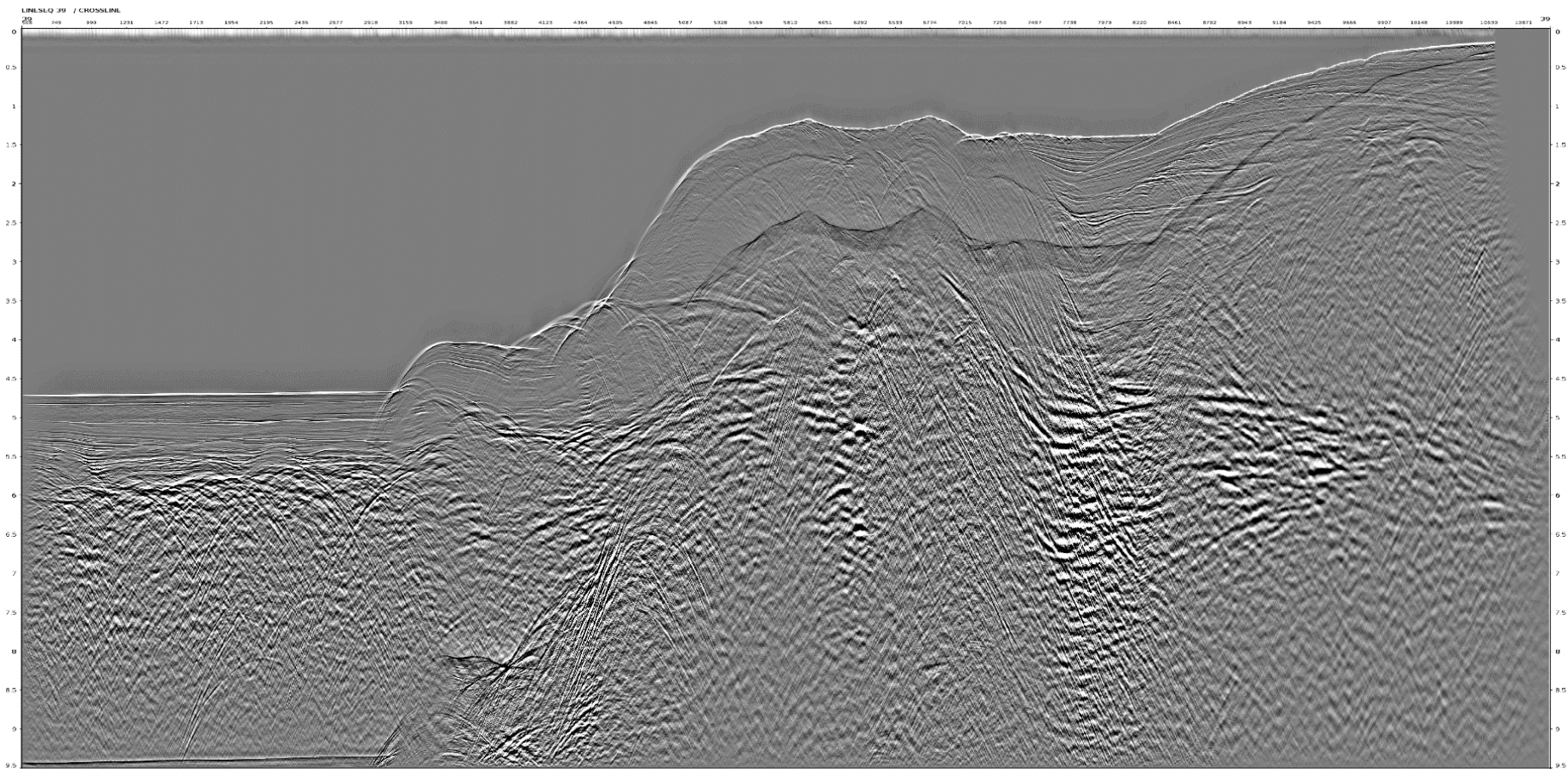
Seq 039

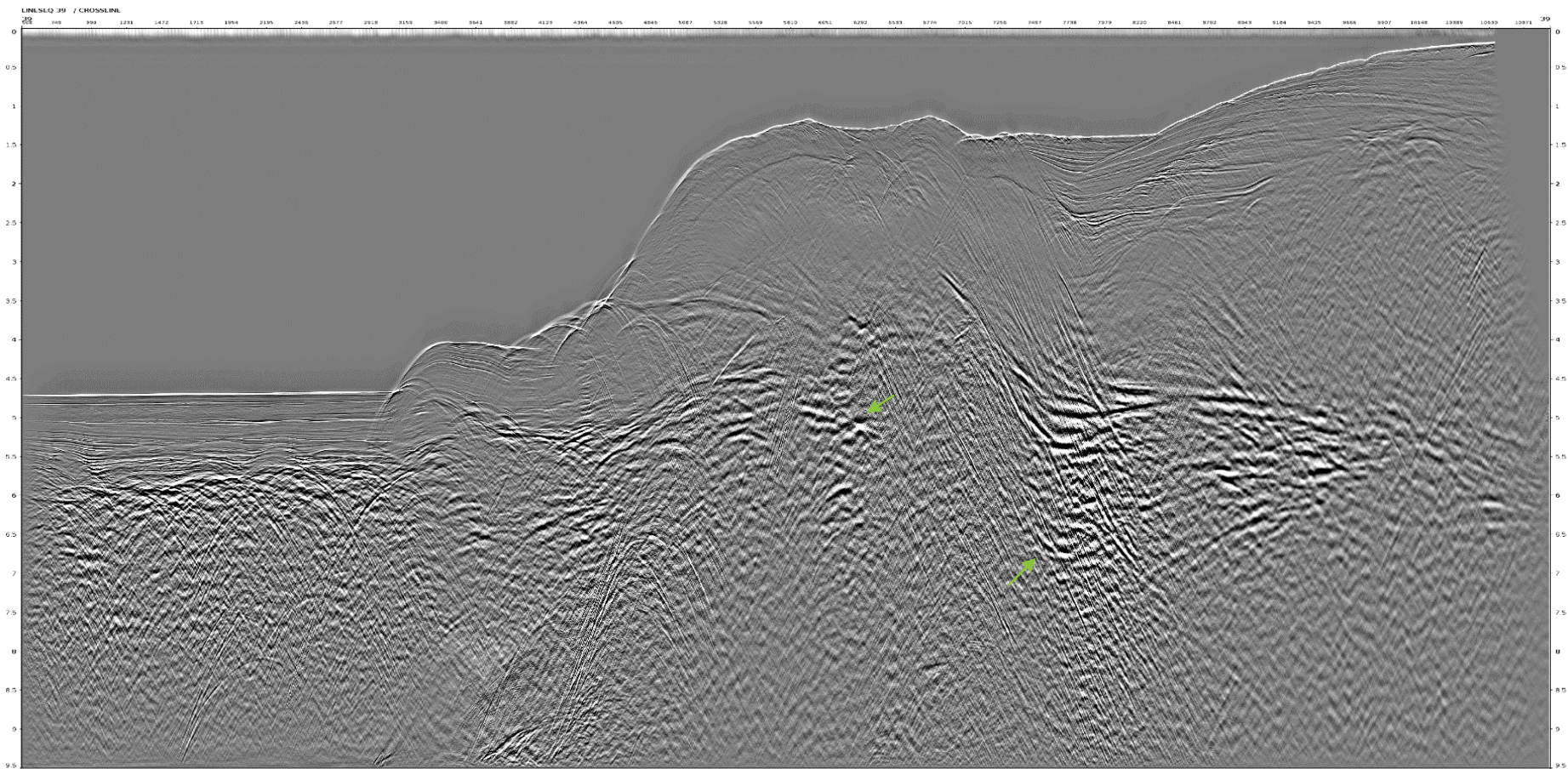
Stack

Common Channel

Shot Gathers

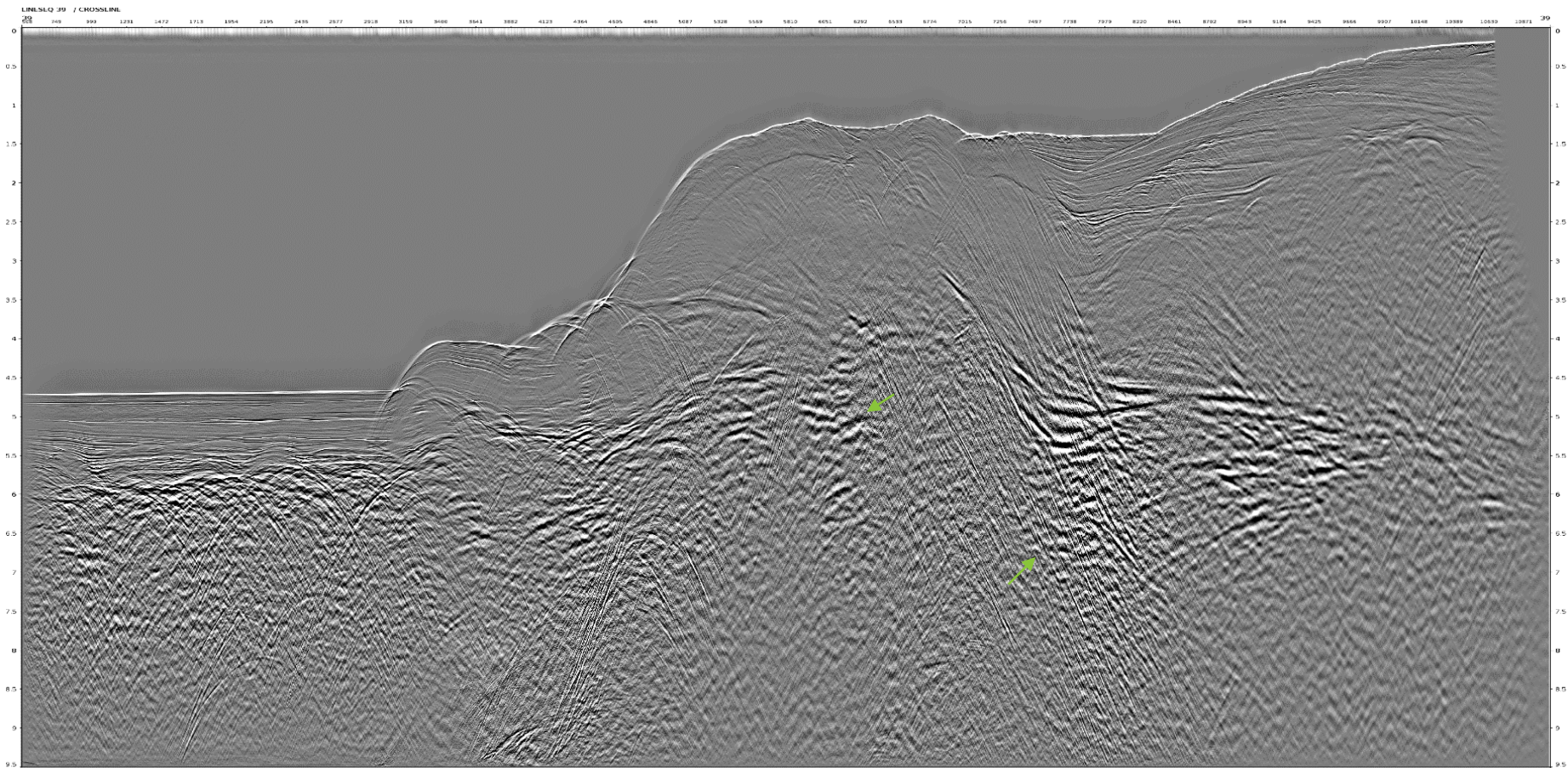






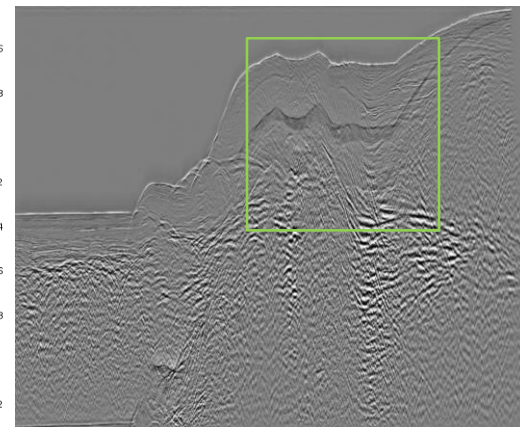
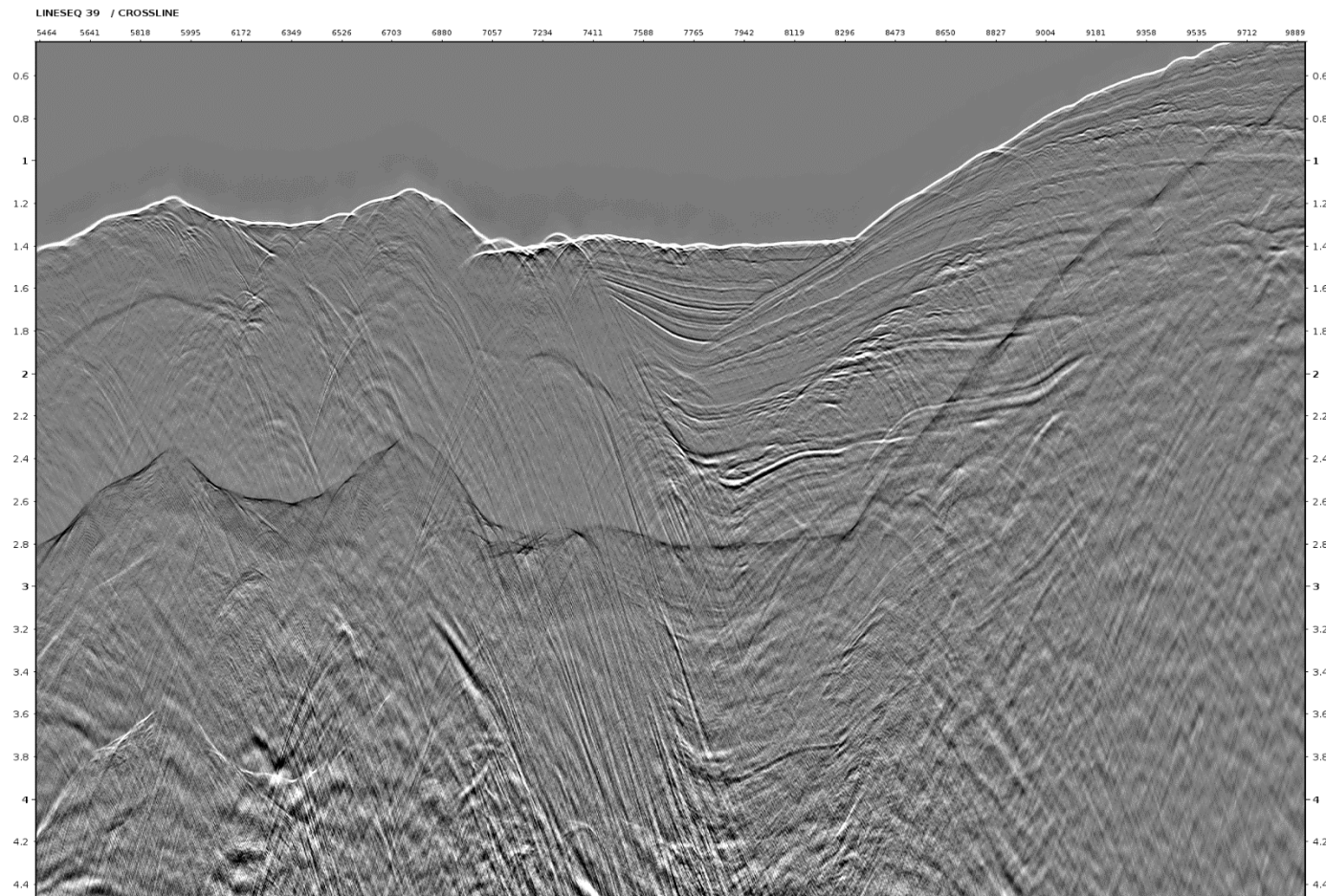
Stack after SRME & MWD Subtraction

8



Zoom in Stack before Subtraction

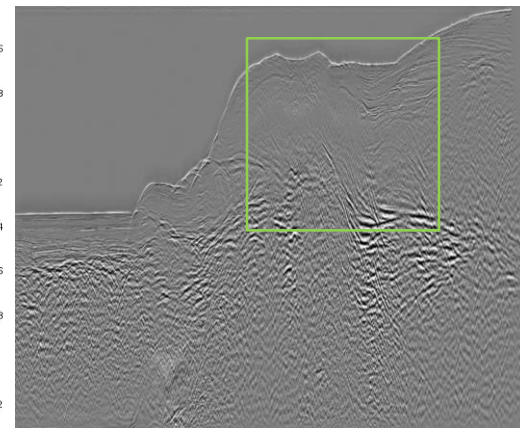
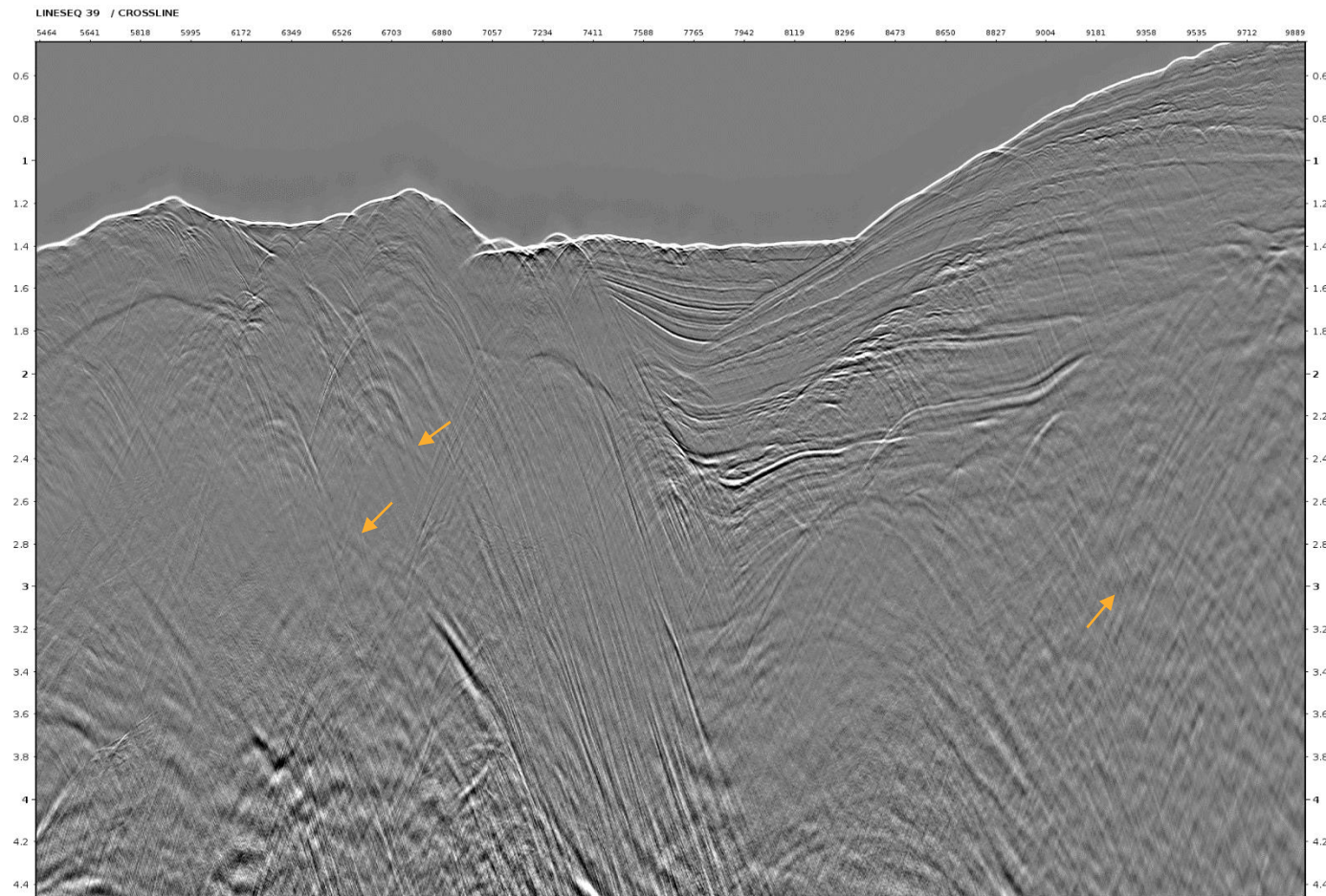
9



- Primaries are protected by simultaneous subtraction flow.

Zoom in Stack after SRME Subtraction

10

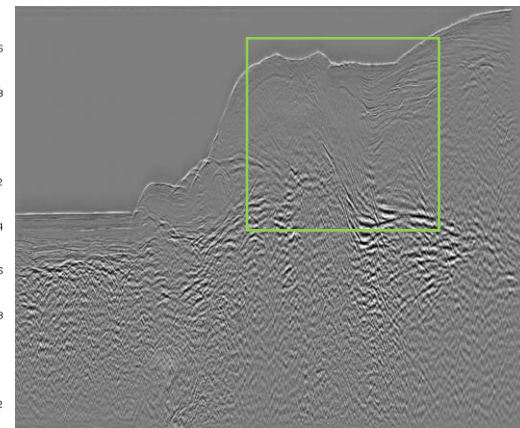
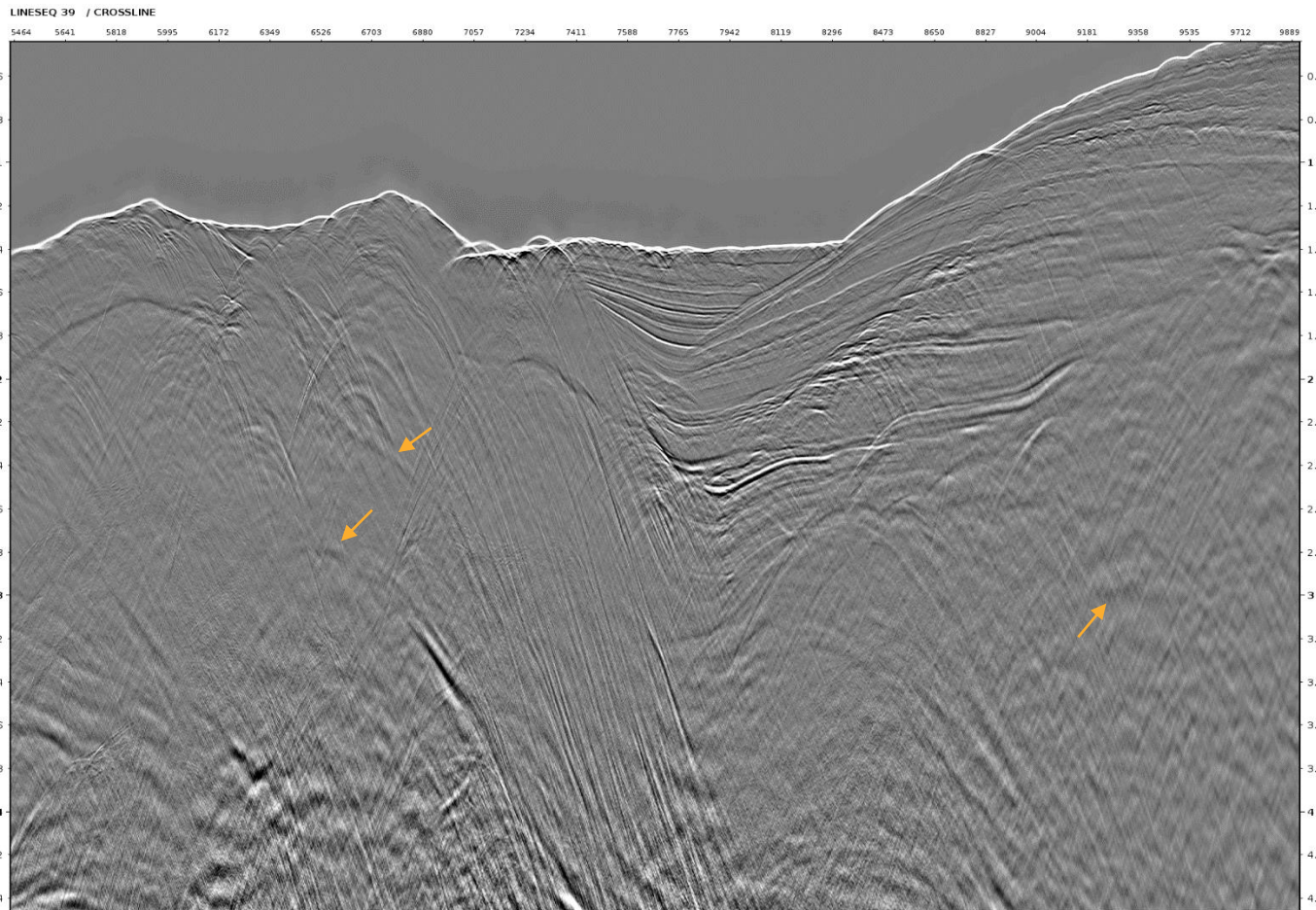


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Zoom in Stack after SRME & MWD Subtraction

11

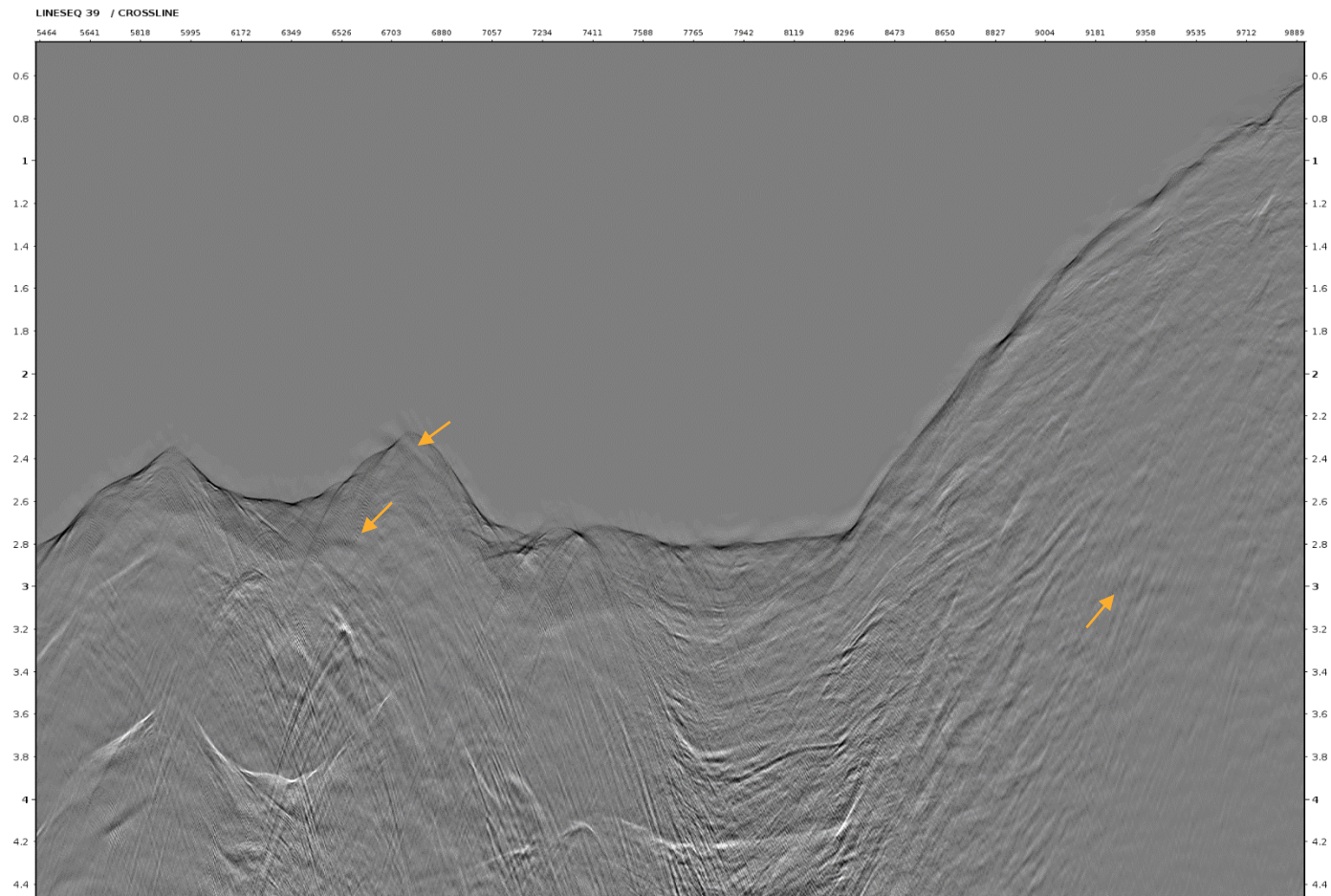


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Difference before – after SRME Subtraction

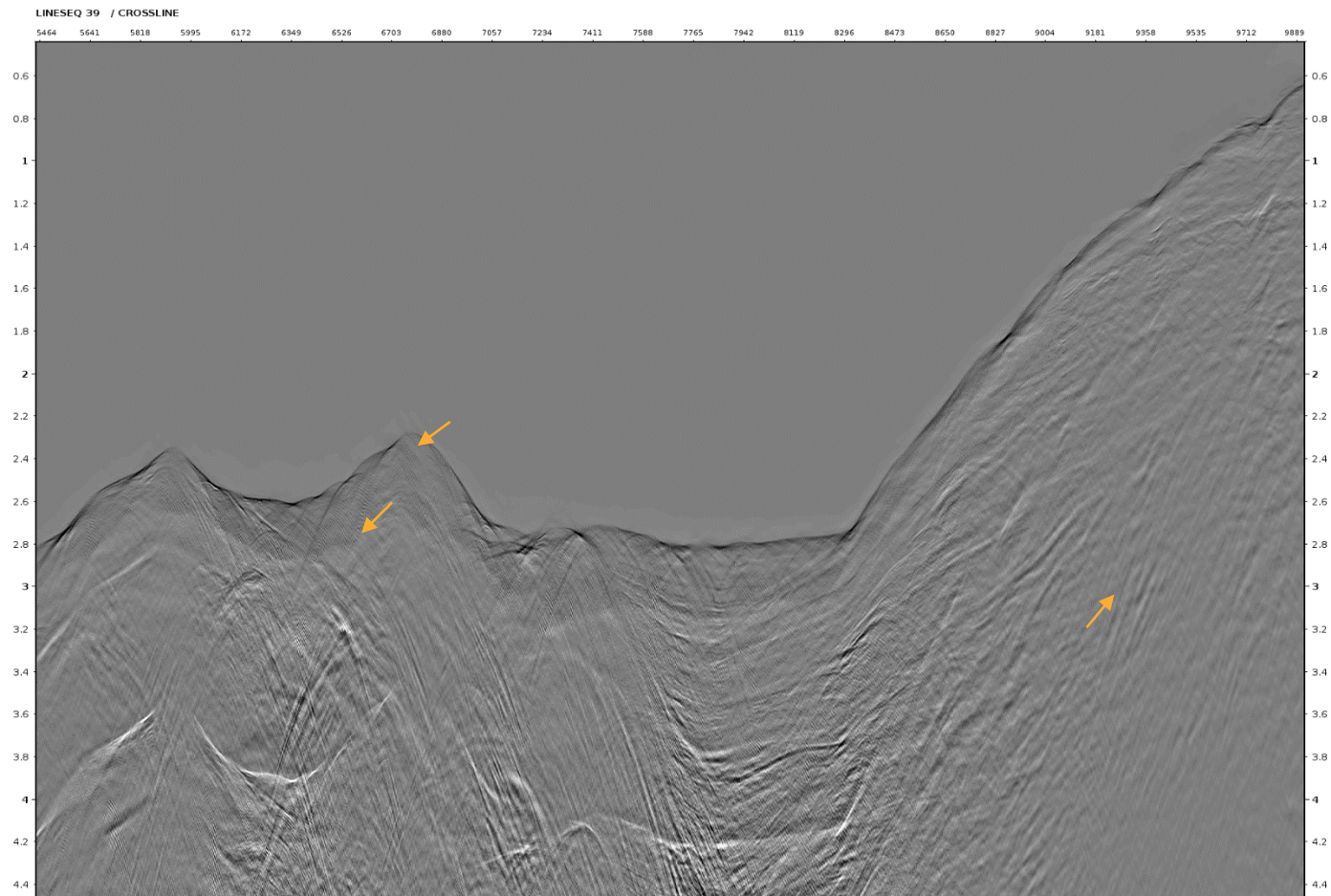
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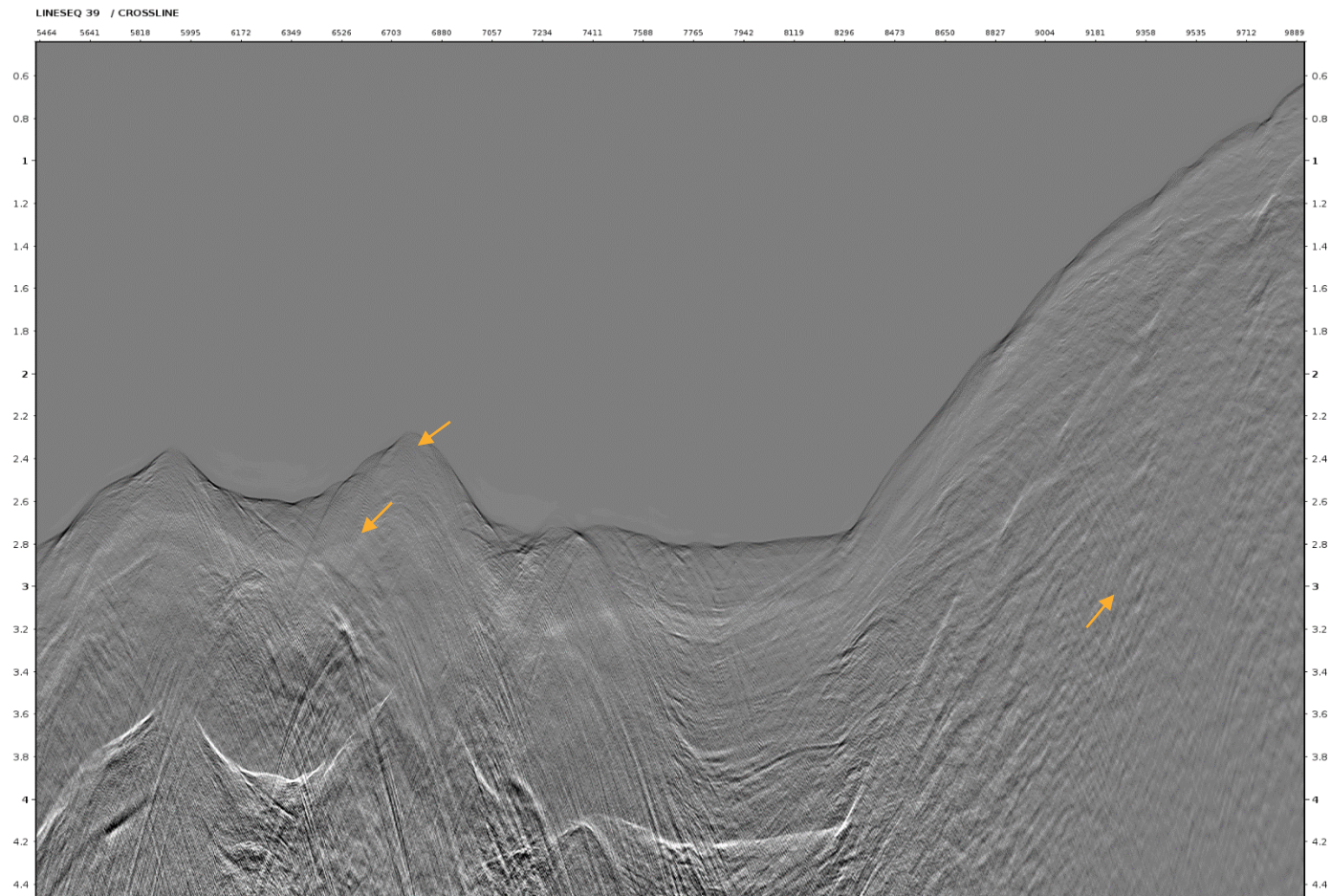
Difference before – after SRME & MWD Subtraction

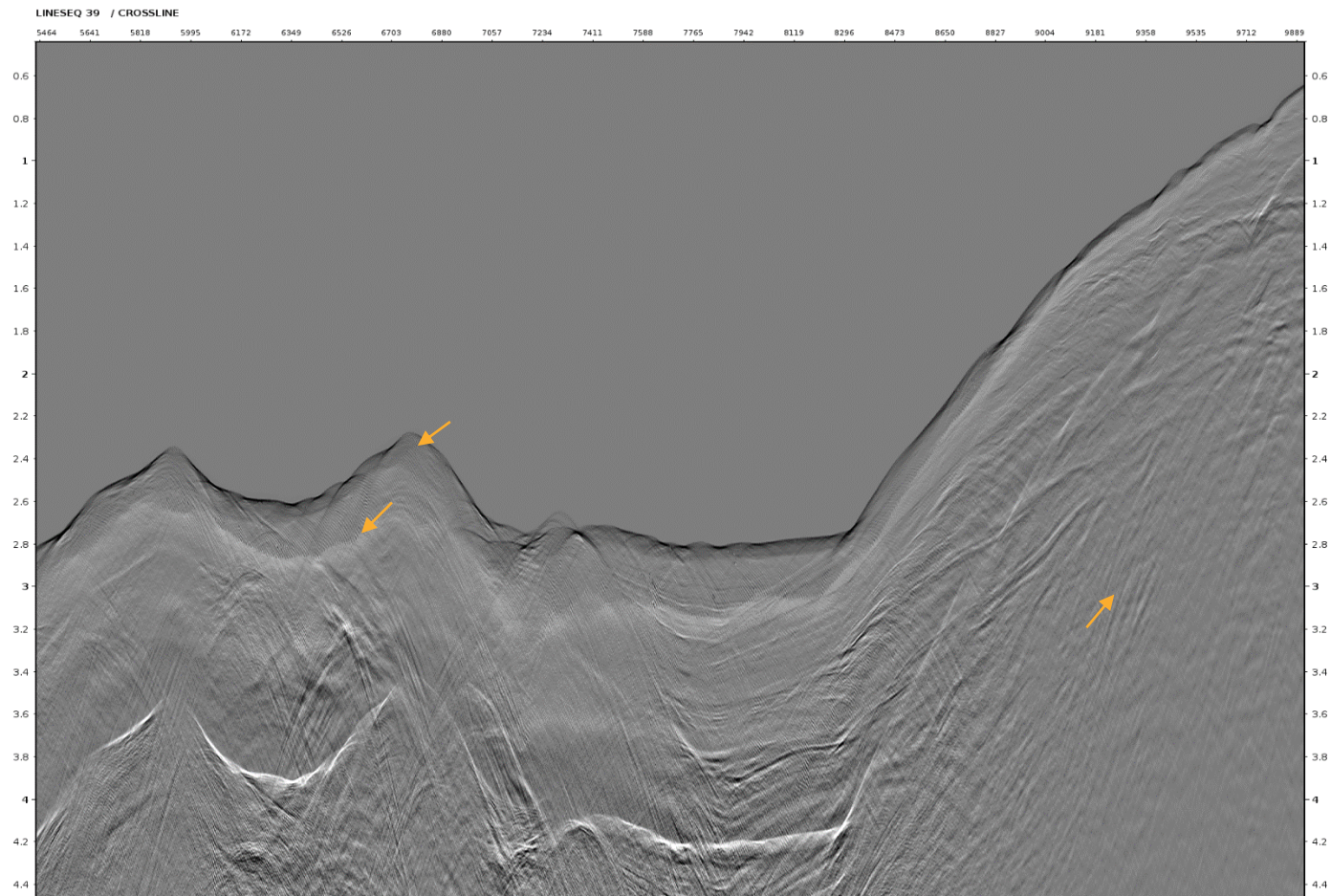
13



Zoom in Stack – SRME Model

14

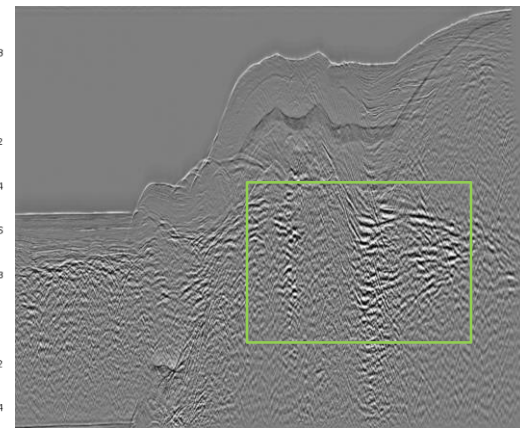
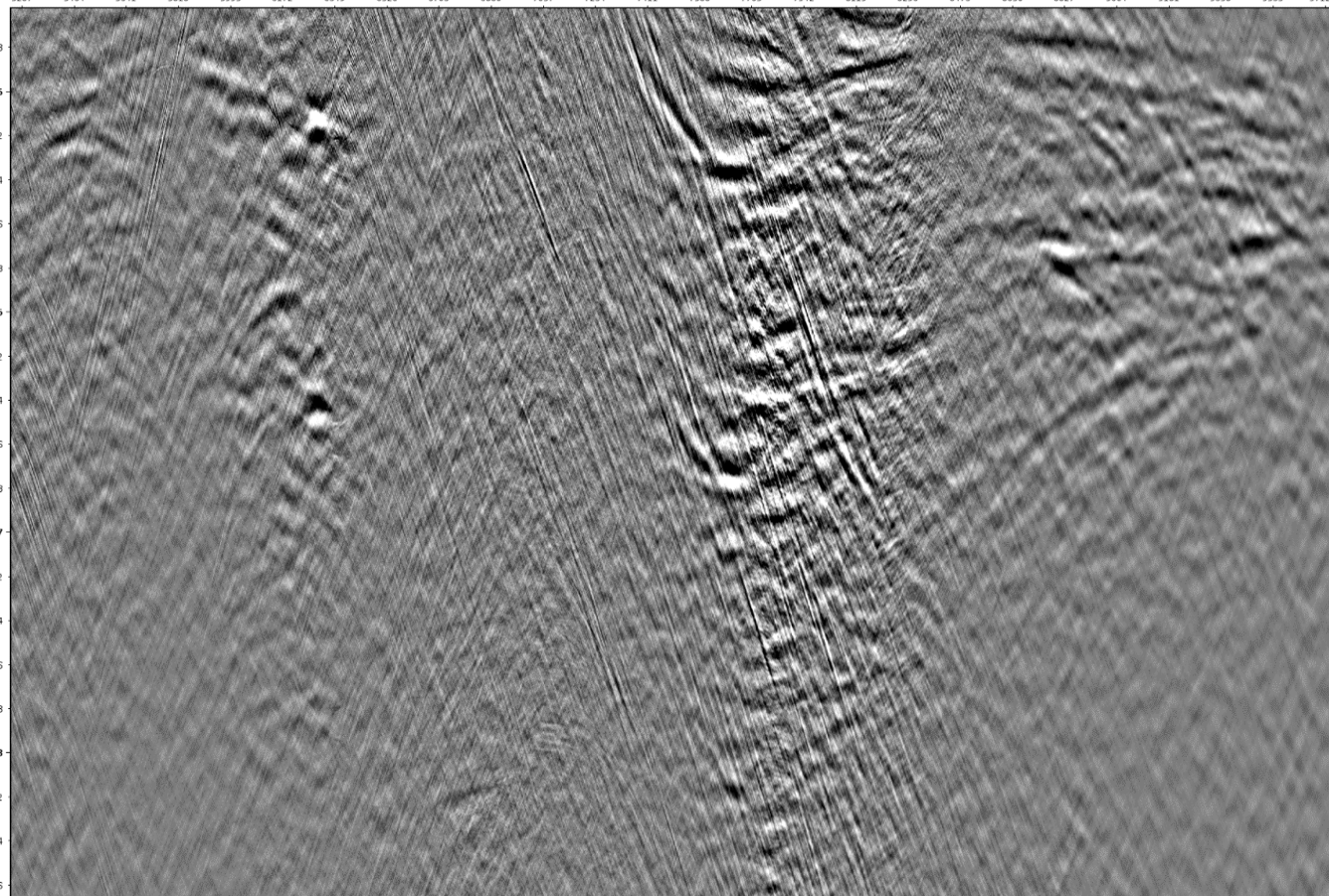




Zoom in Stack before Subtraction

16

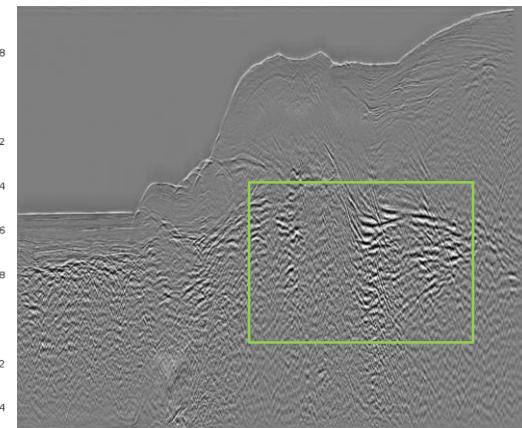
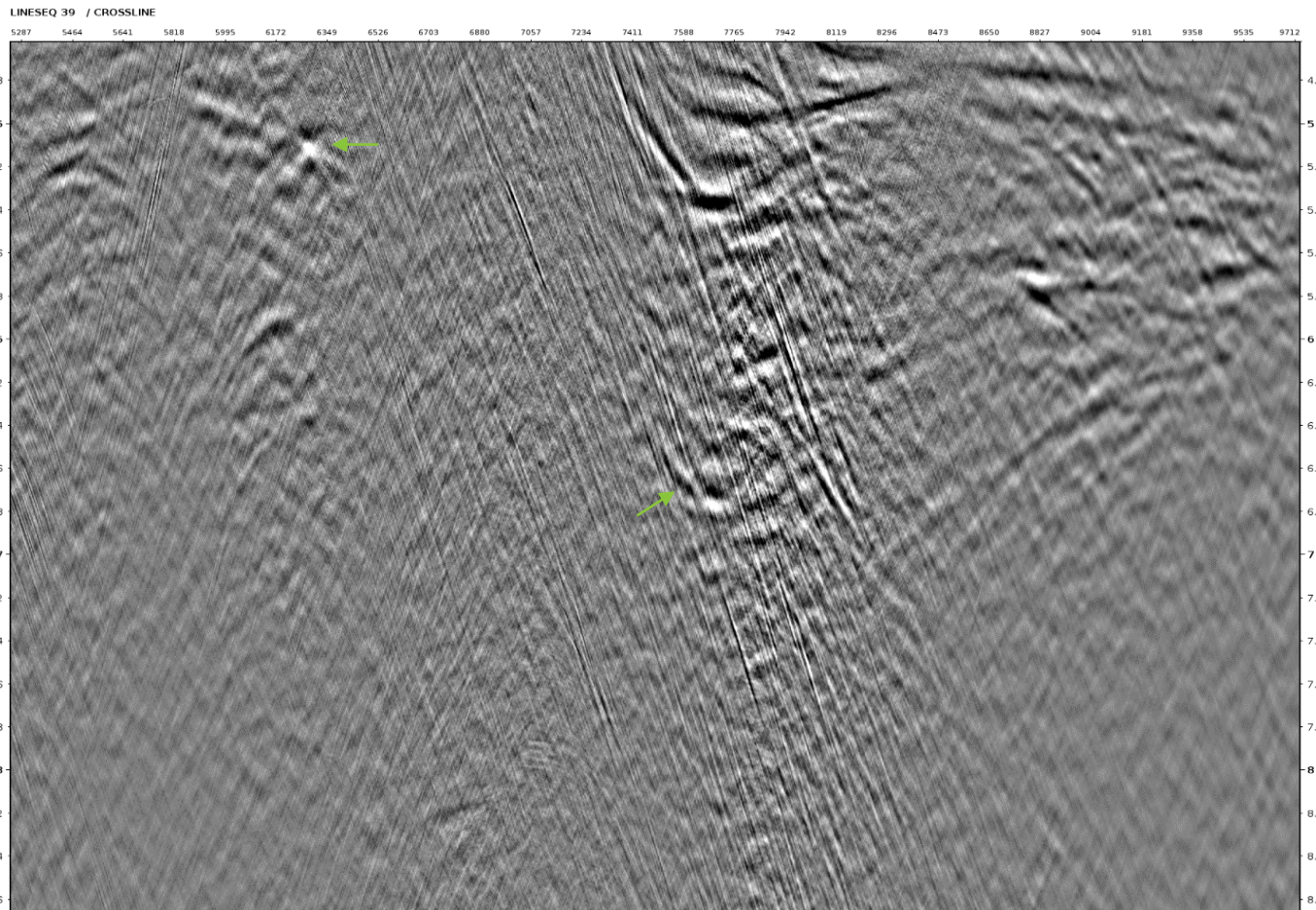
LINESEQ 39 / CROSSLINE



- Multiples are better attenuated with simultaneous subtraction.

Zoom in Stack after SRME Subtraction

17

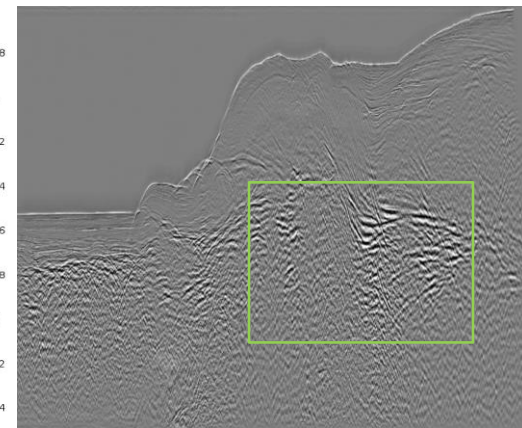
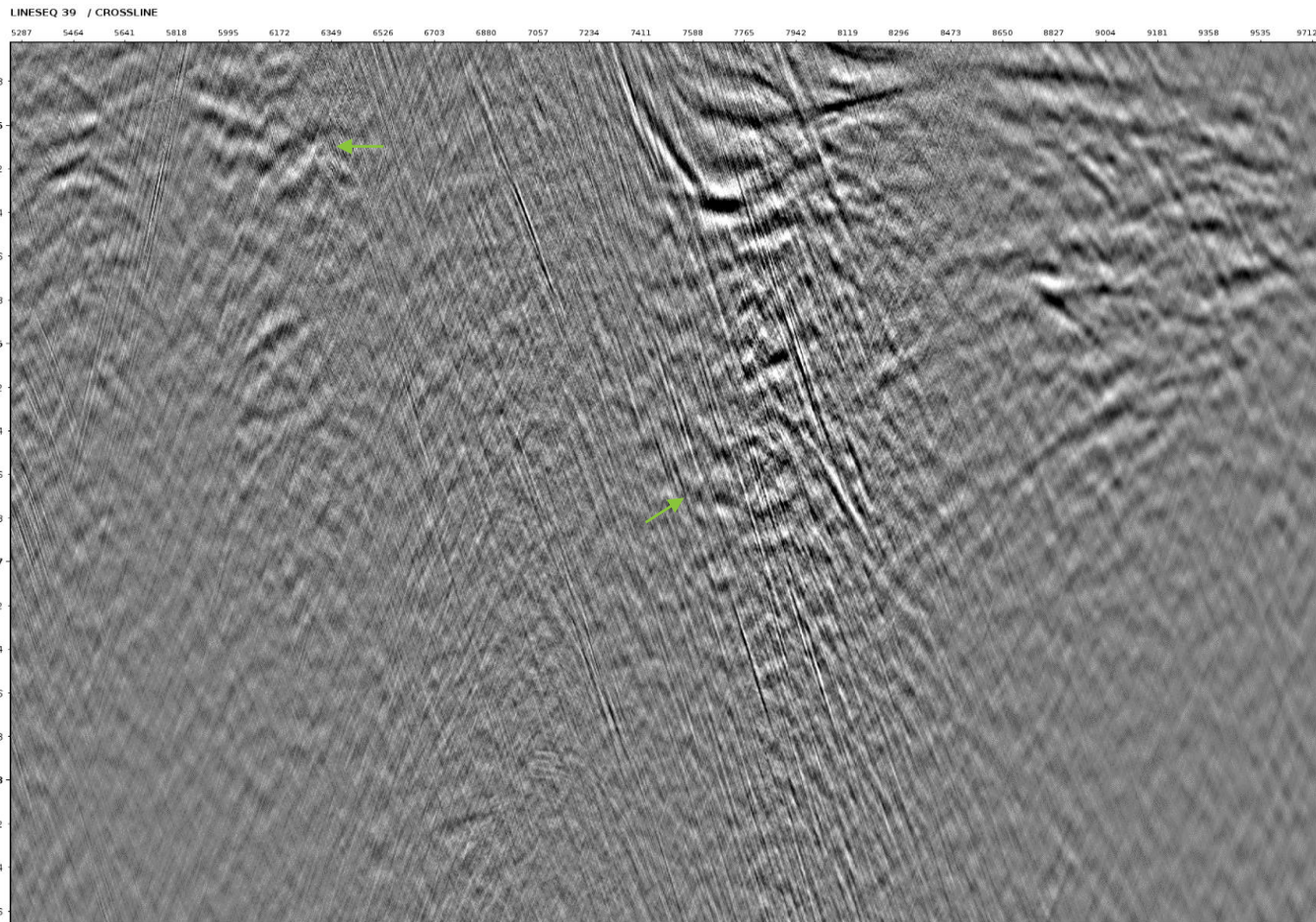


- Multiples are better attenuated with simultaneous subtraction.



Zoom in Stack after SRME & MWD Subtraction

18

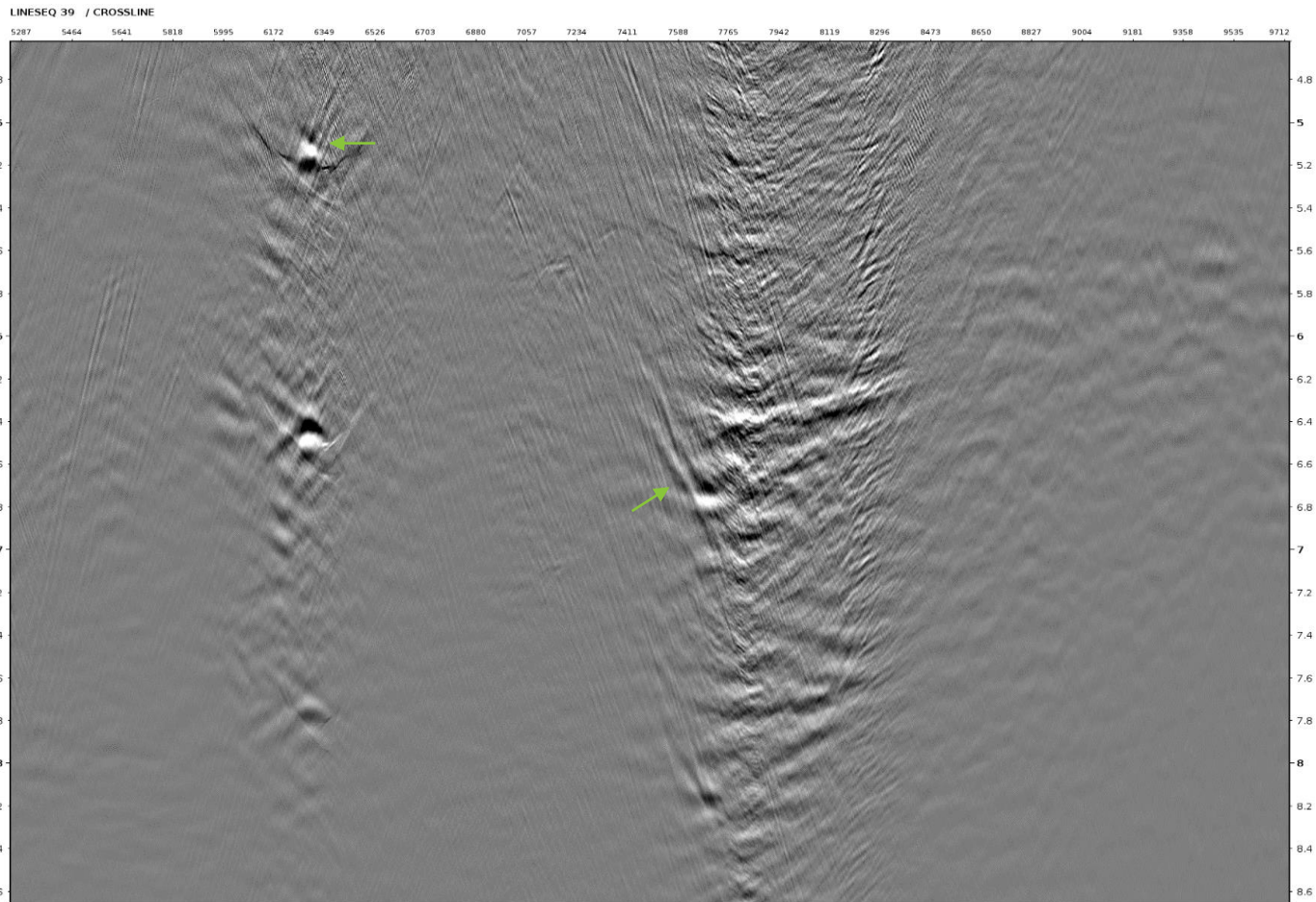


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Difference before – after SRME Subtraction

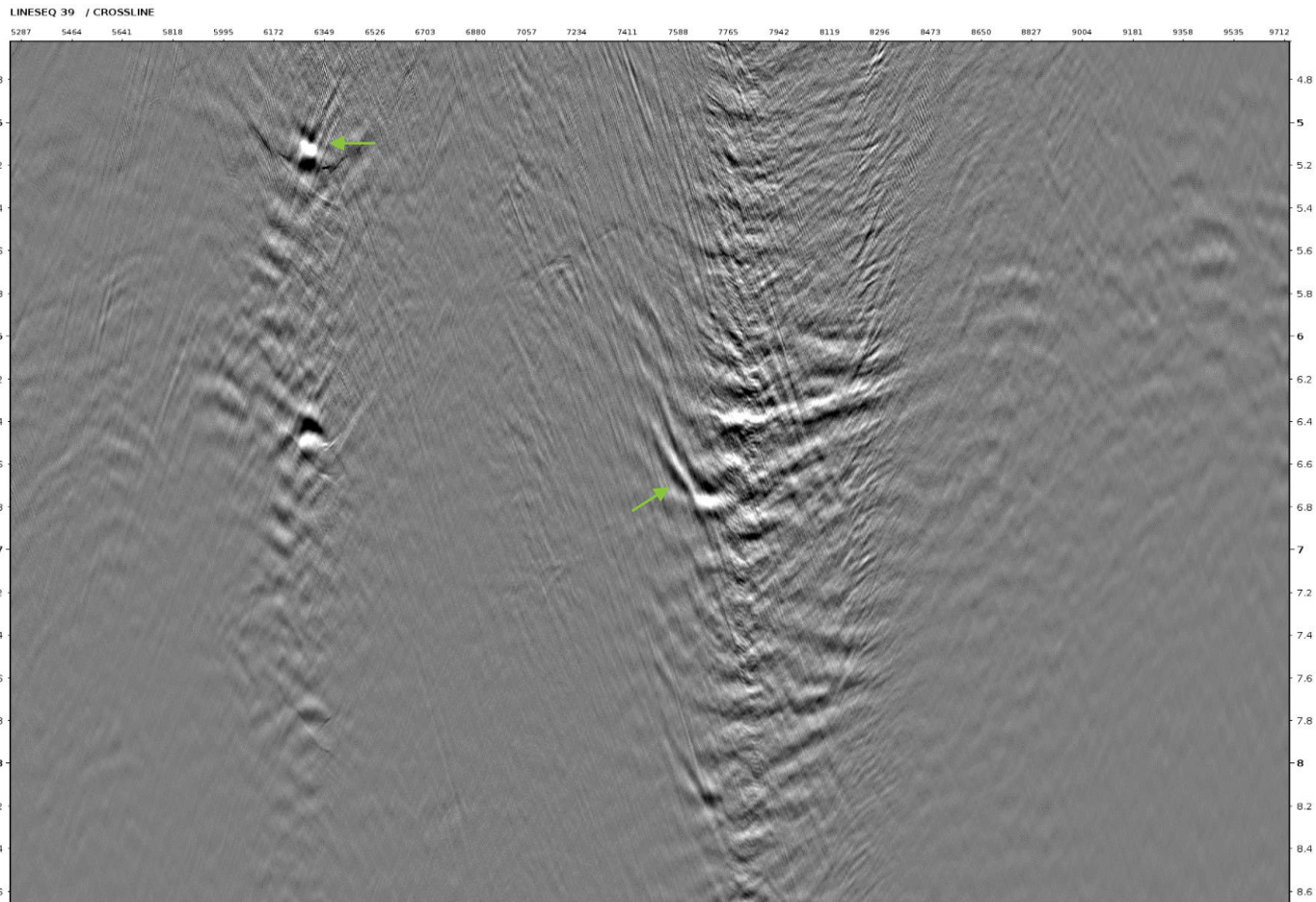
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Difference before – after SRME & MWD Subtraction

20

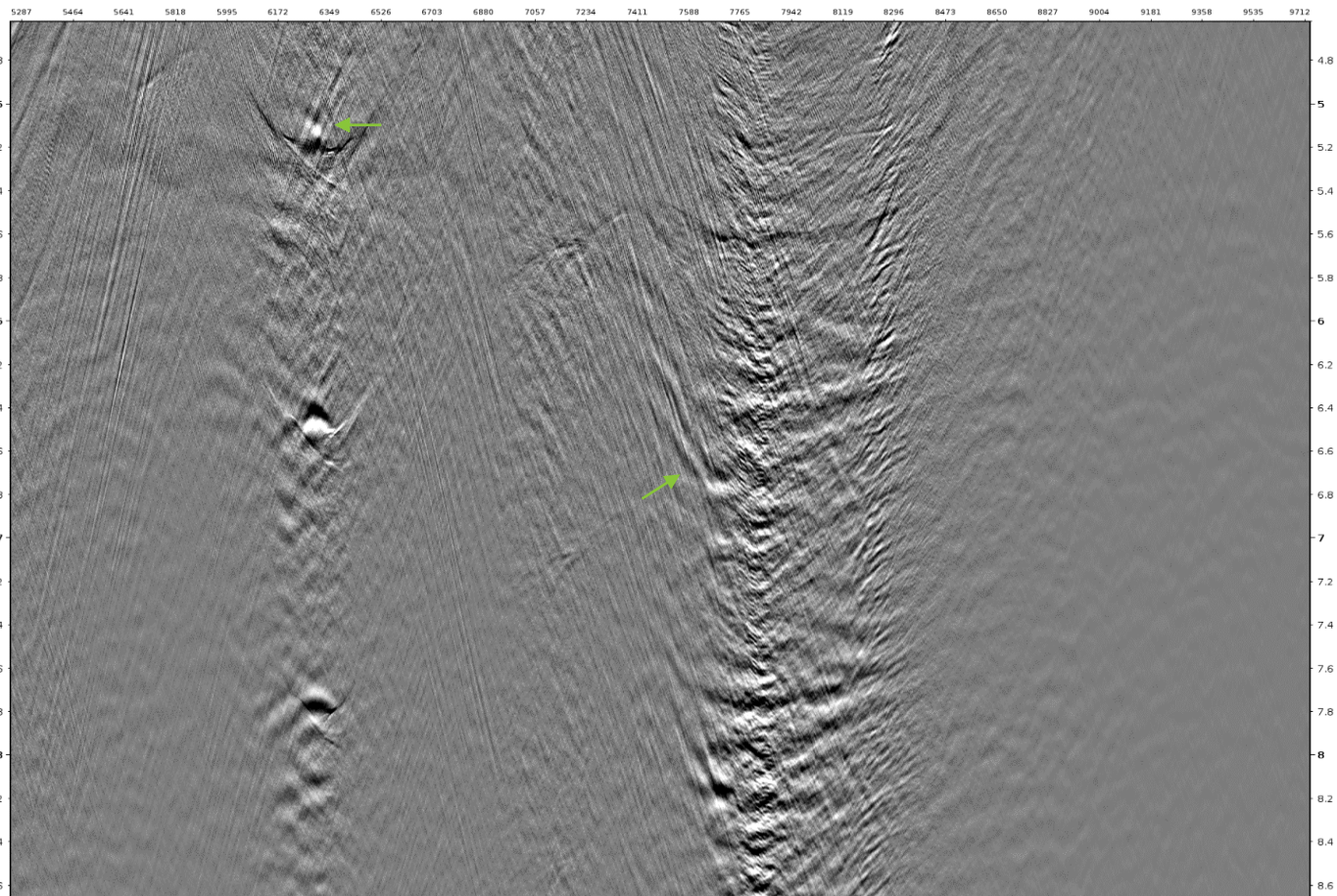




Zoom in Stack – SRME Model

21

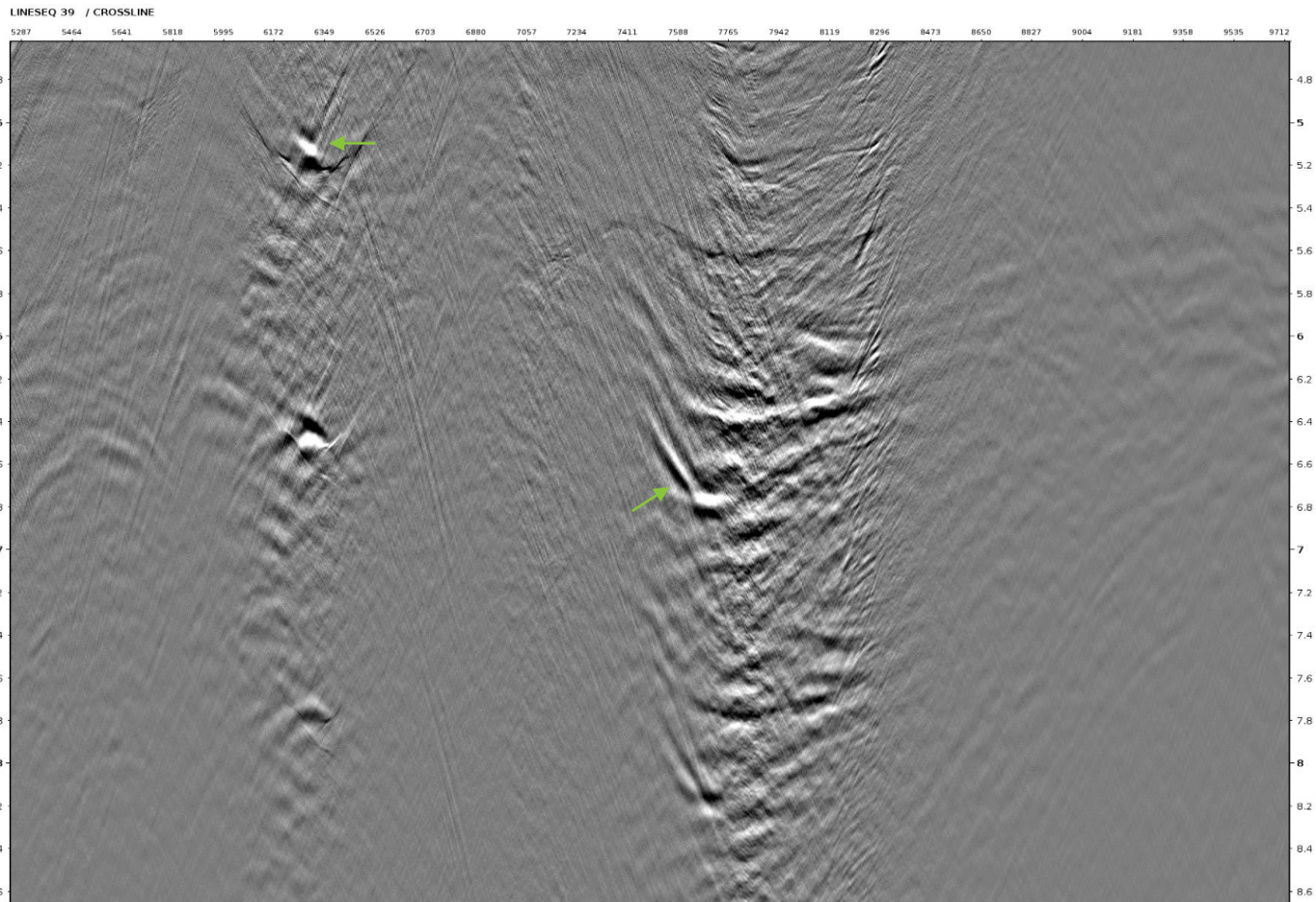
LINESEQ 39 / CROSSLINE





Zoom in Stack – MWD Model

22



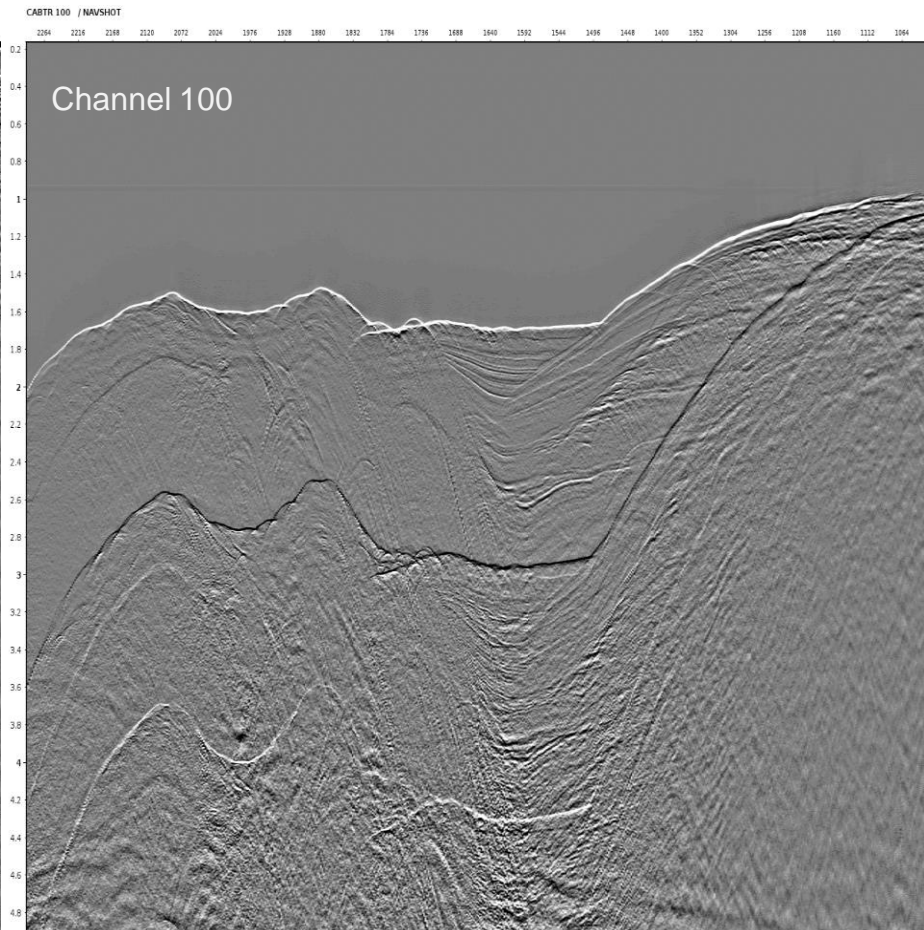
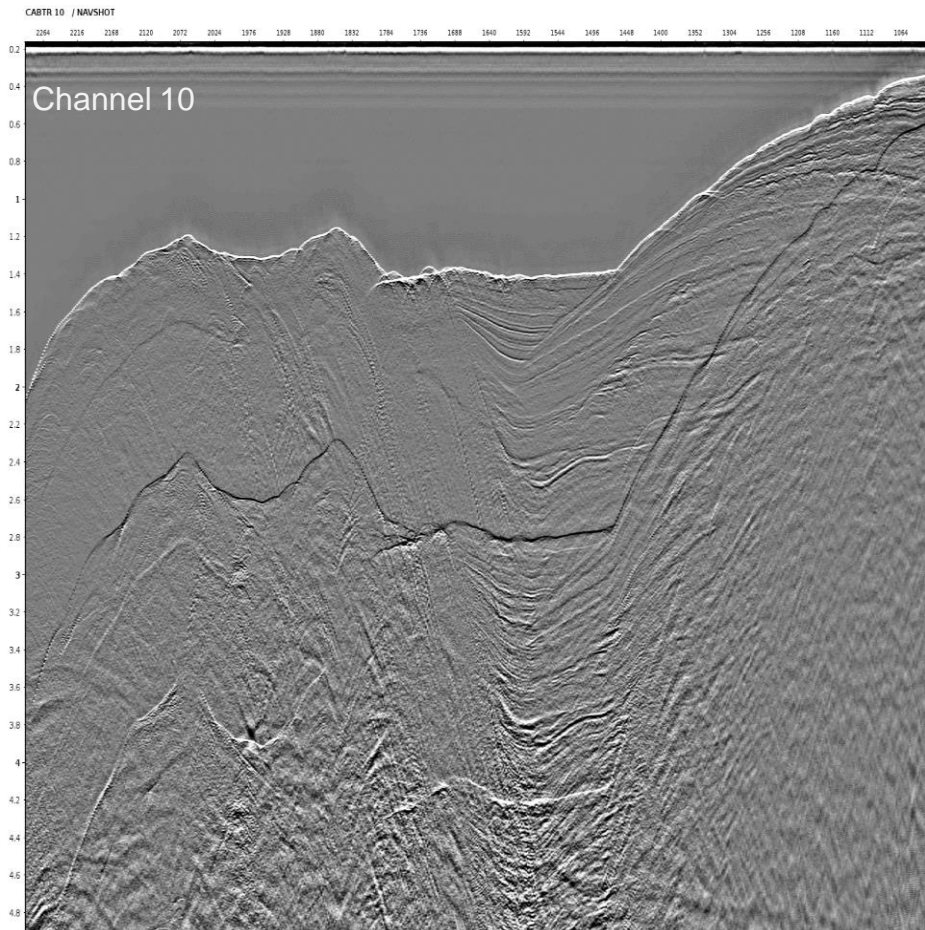
Seq 039

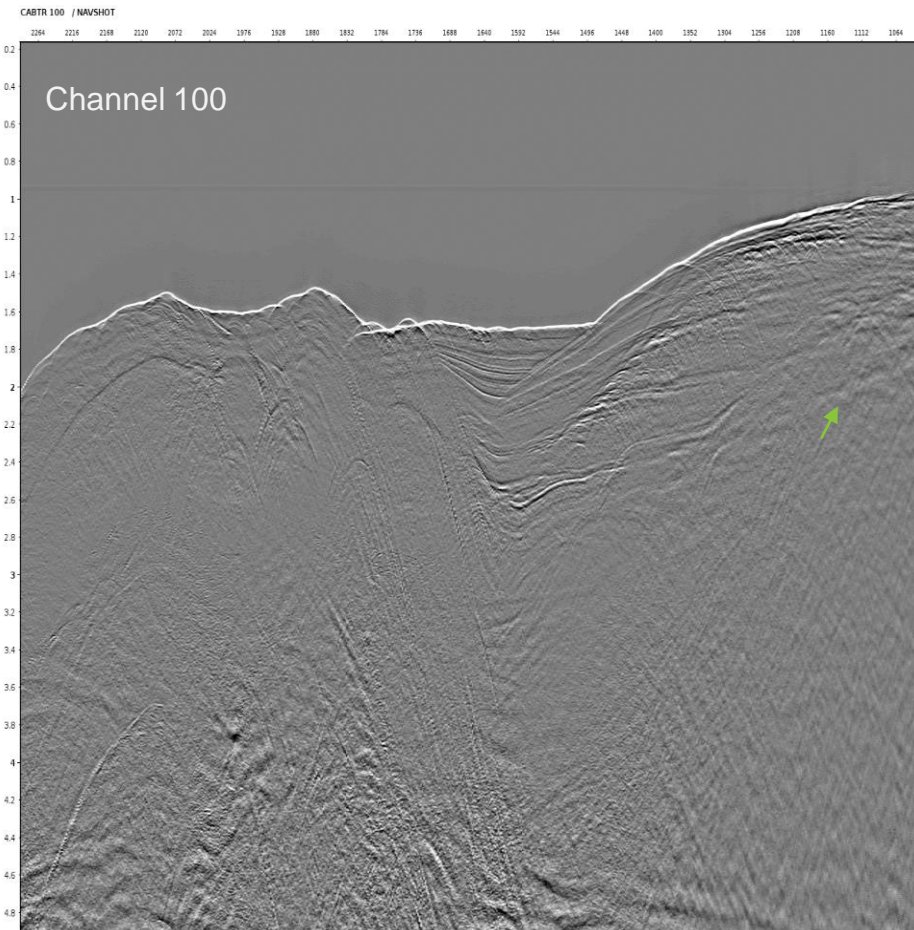
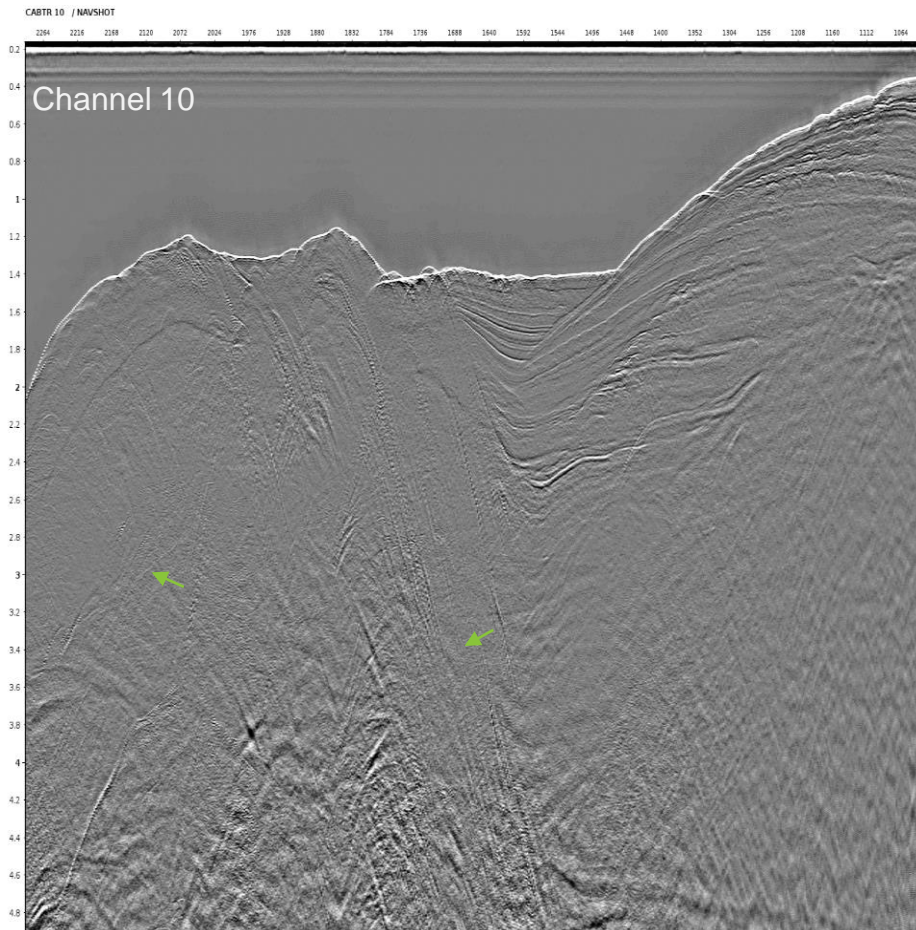
Stack

Common Channel

Shot Gathers

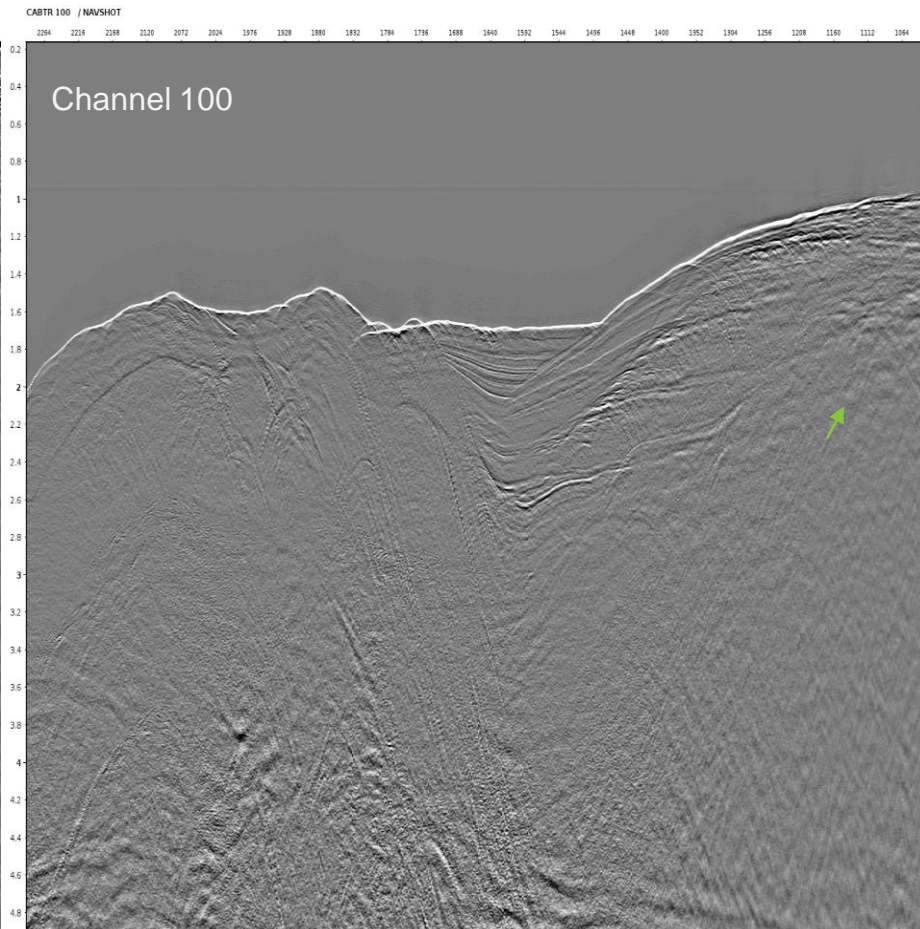
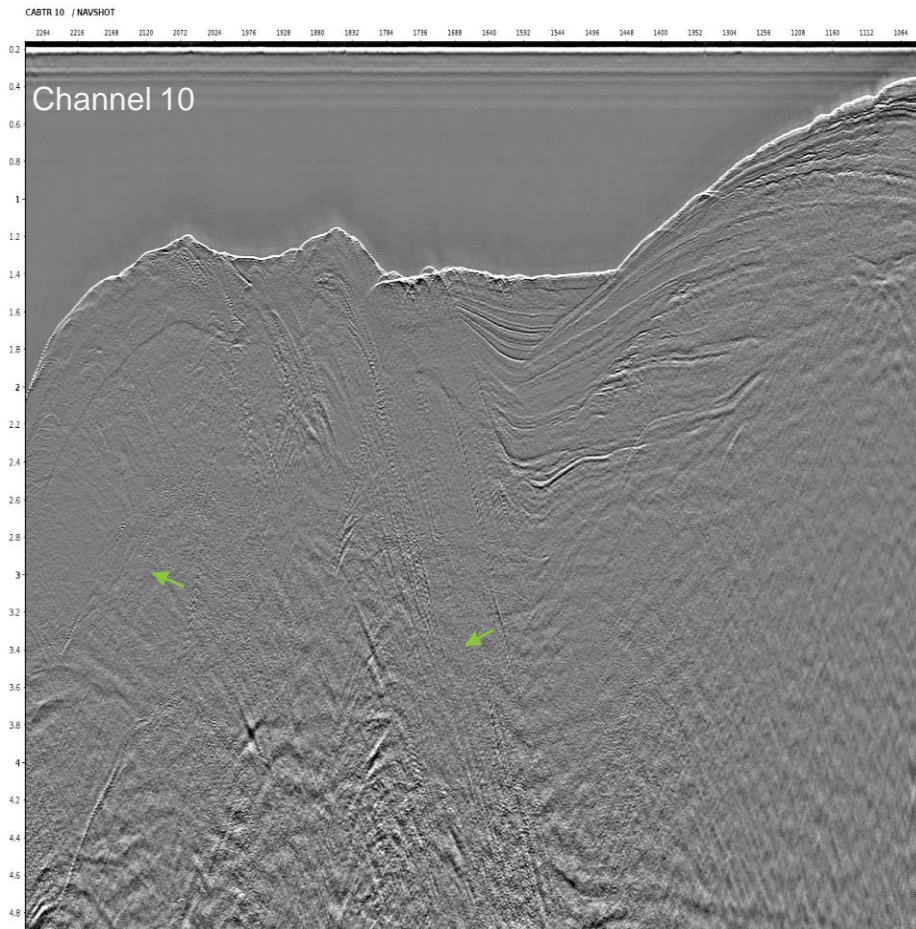






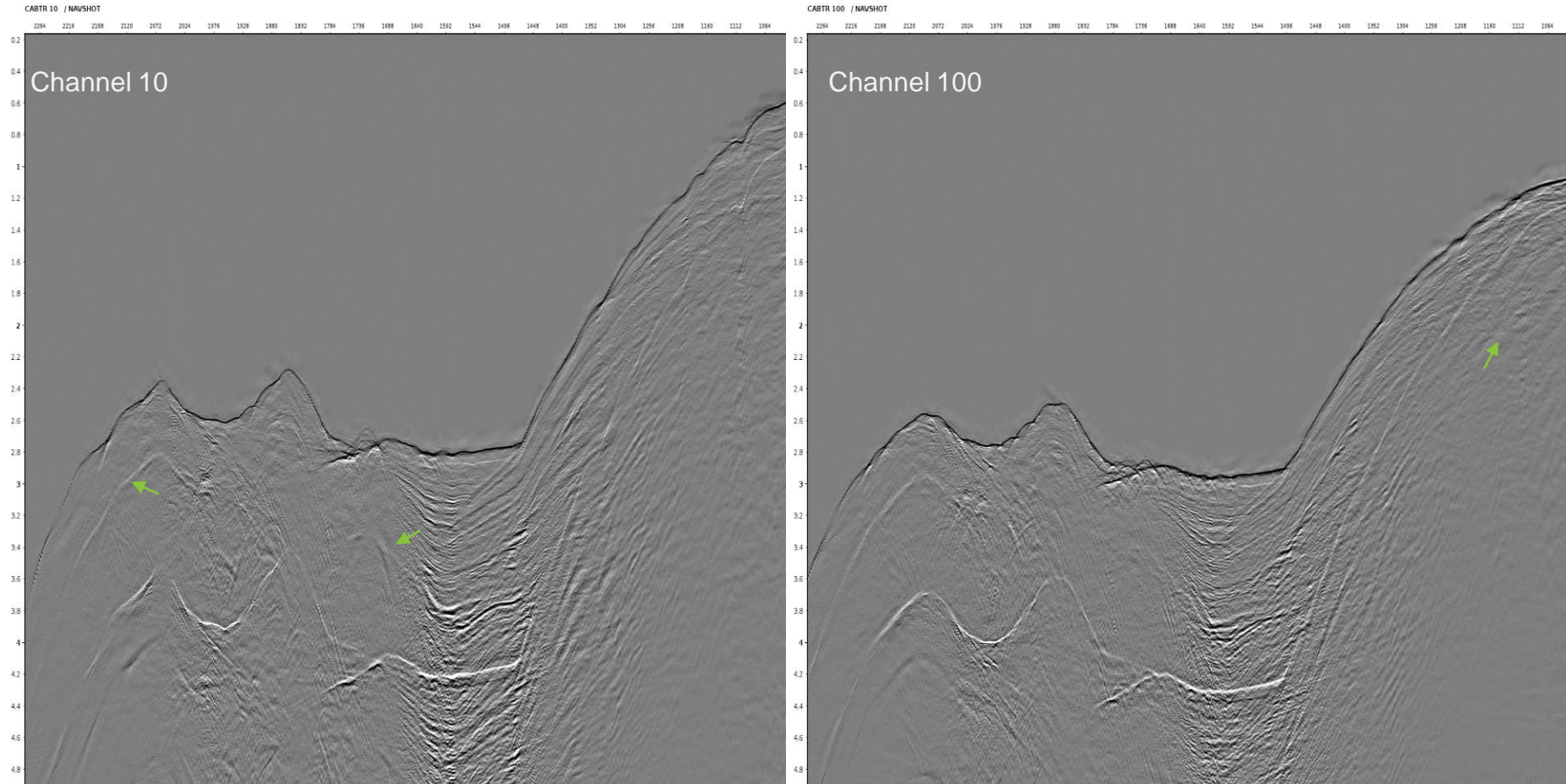


Common Channel **after** SRME & MWD Subtraction





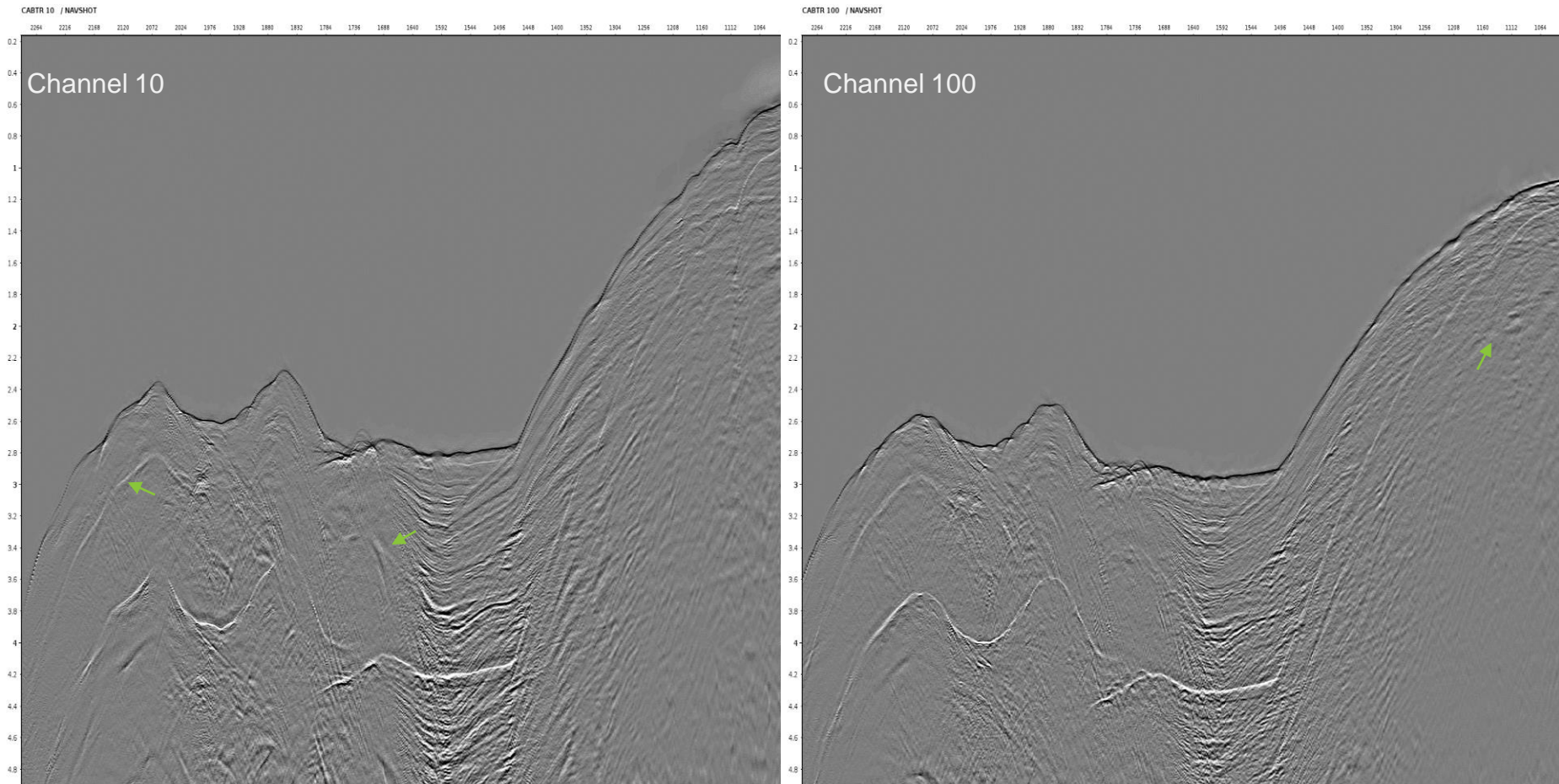
Difference before - after SRME Subtraction

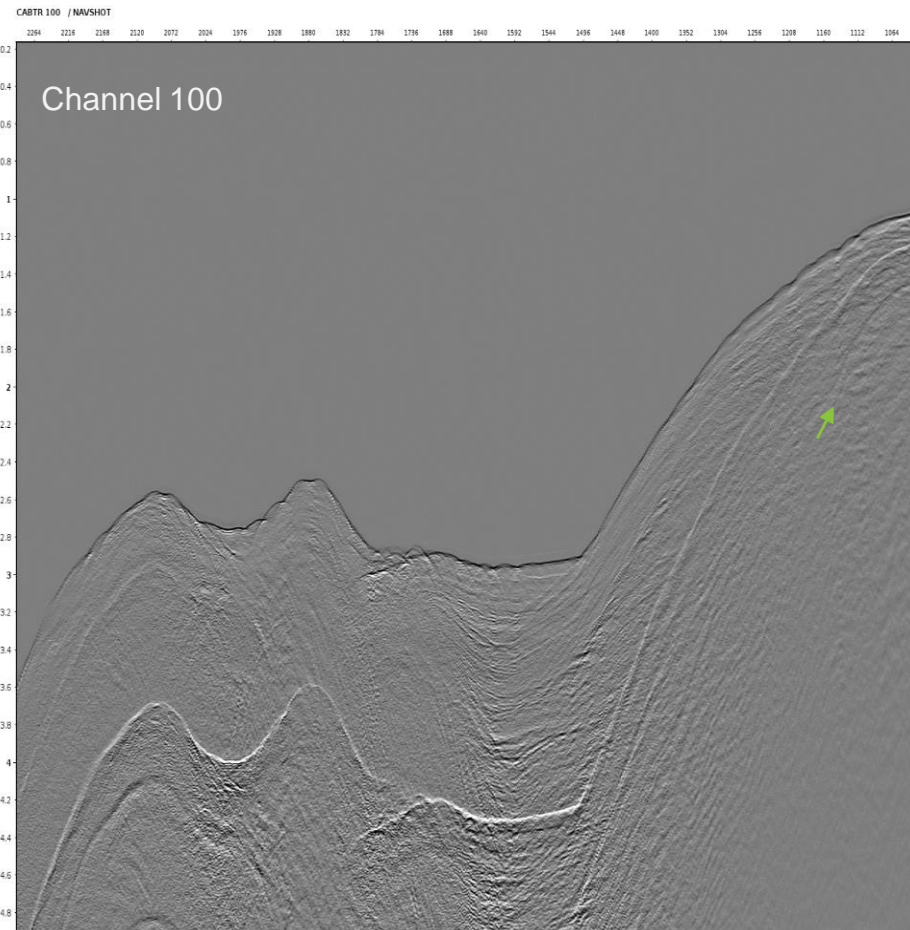
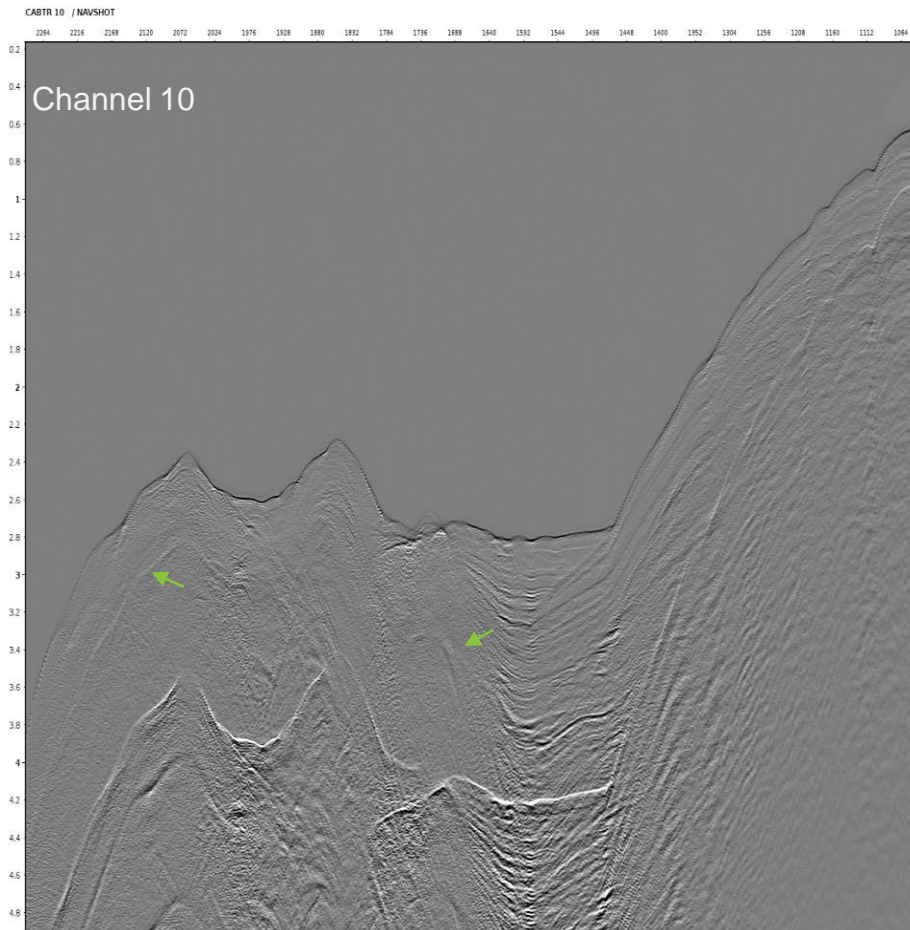




Difference before - after SRME & MWD Subtraction

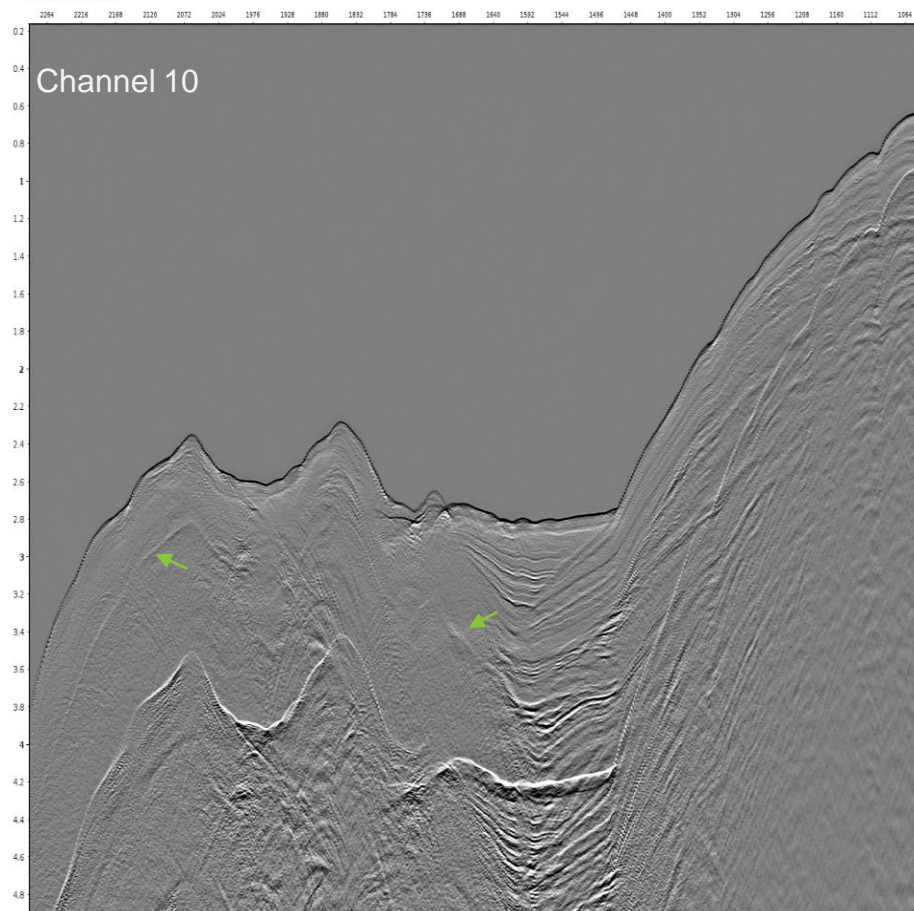
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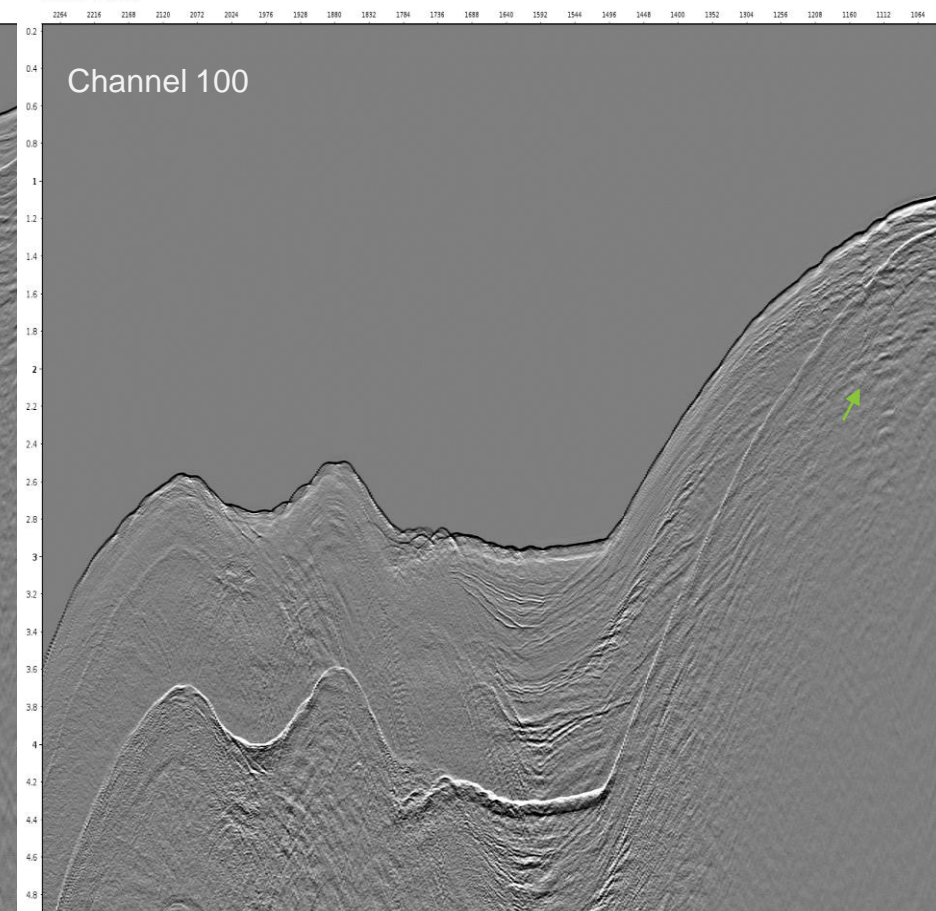




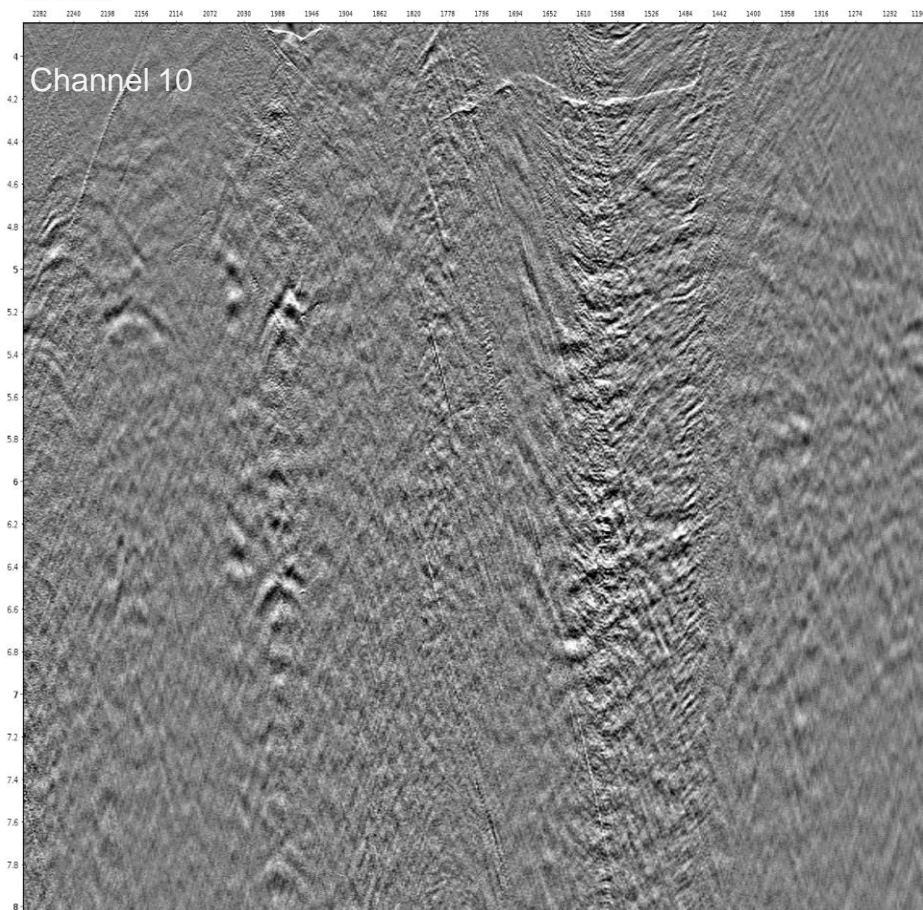
CABTR 10 / NAVSHOT



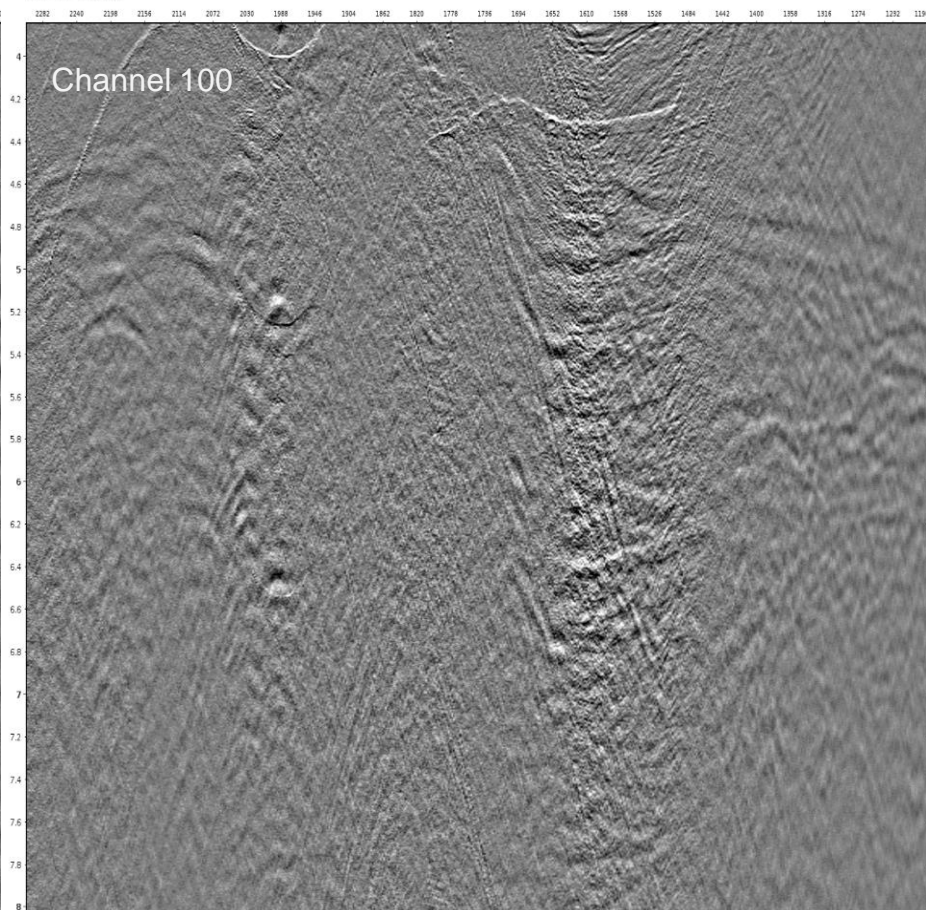
CABTR 100 / NAVSHOT



CABTR 10 / NAVSHOT

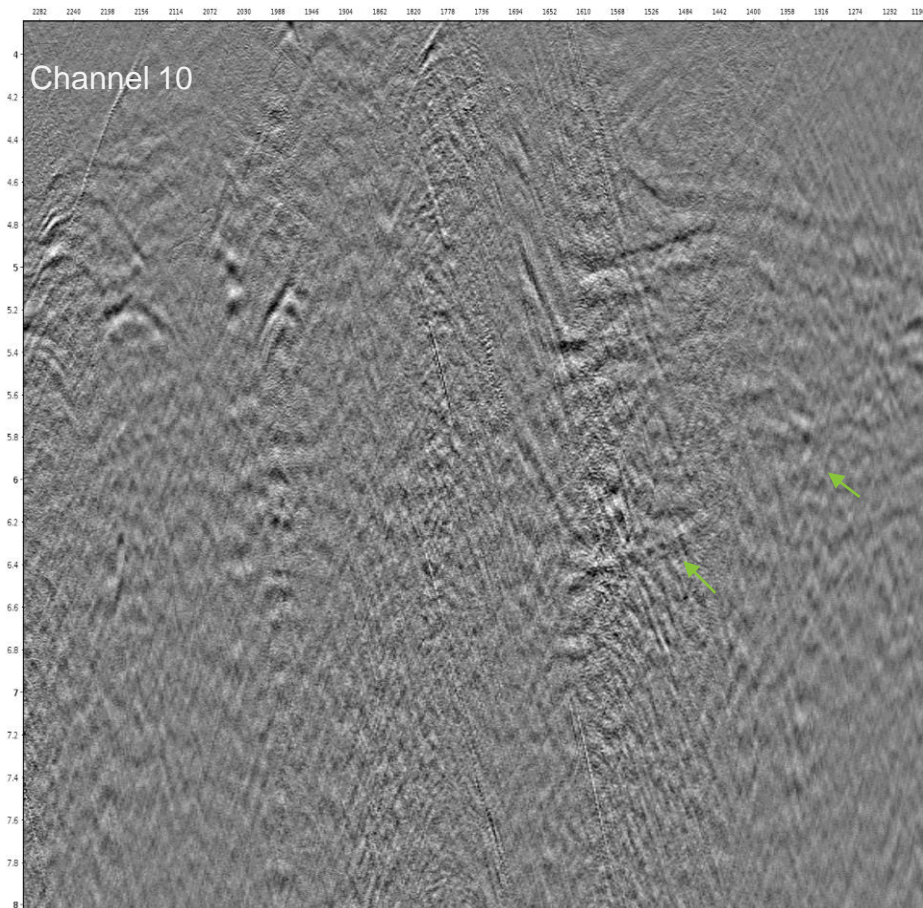


CABTR 100 / NAVSHOT

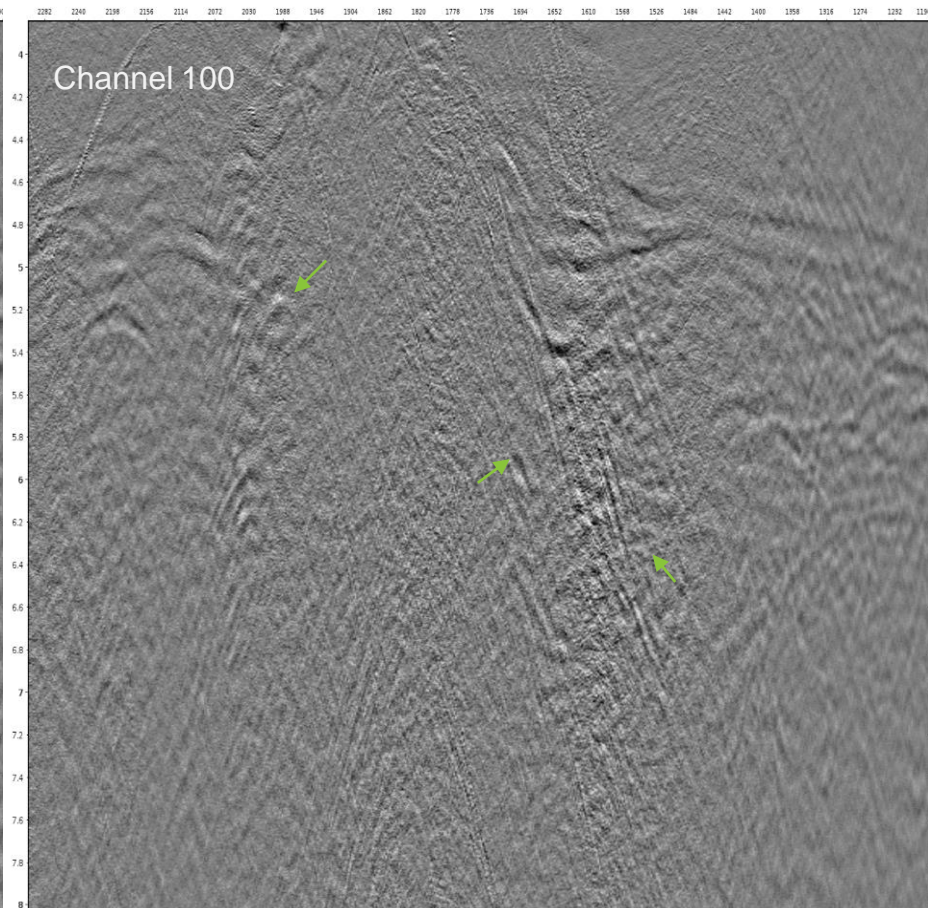




CABTR 10 / NAVSHOT

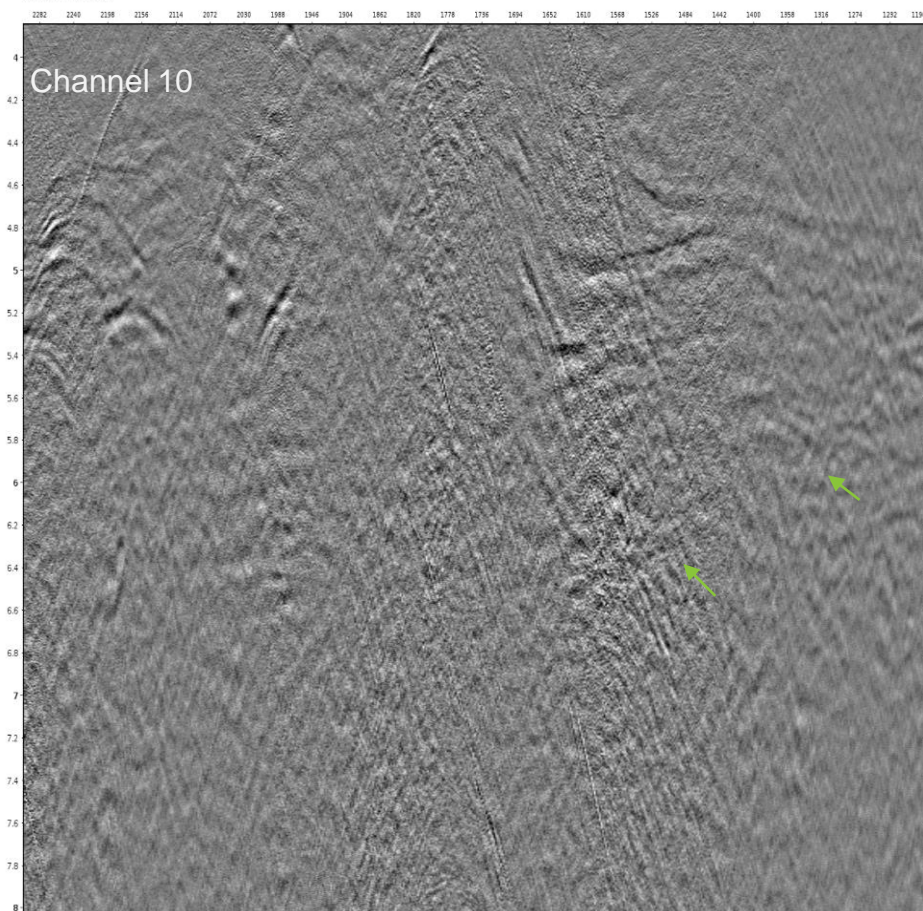


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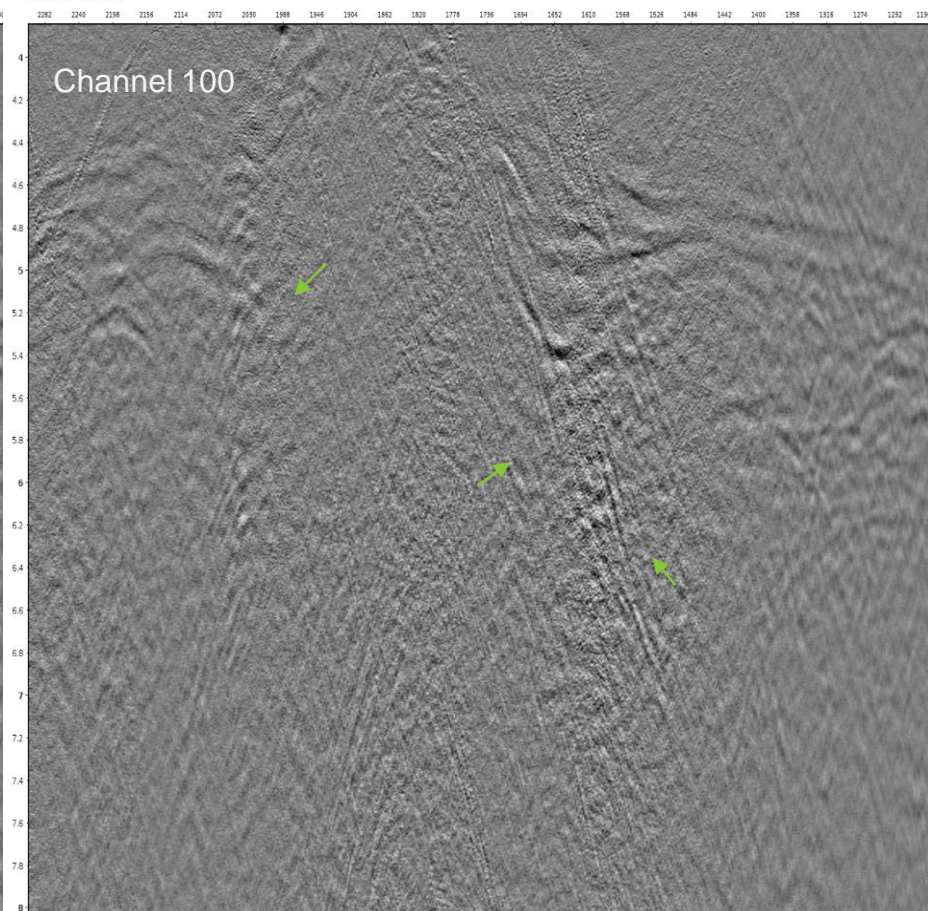




CABTR 10 / NAVSHOT



CABTR 100 / NAVSHOT

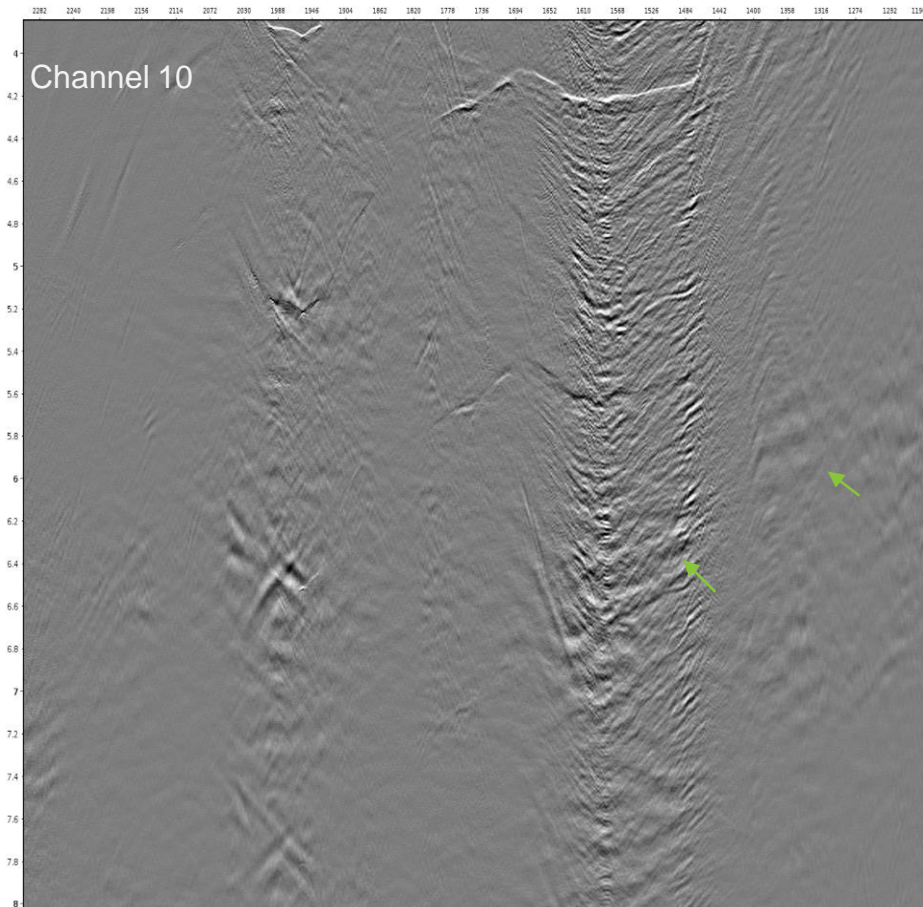




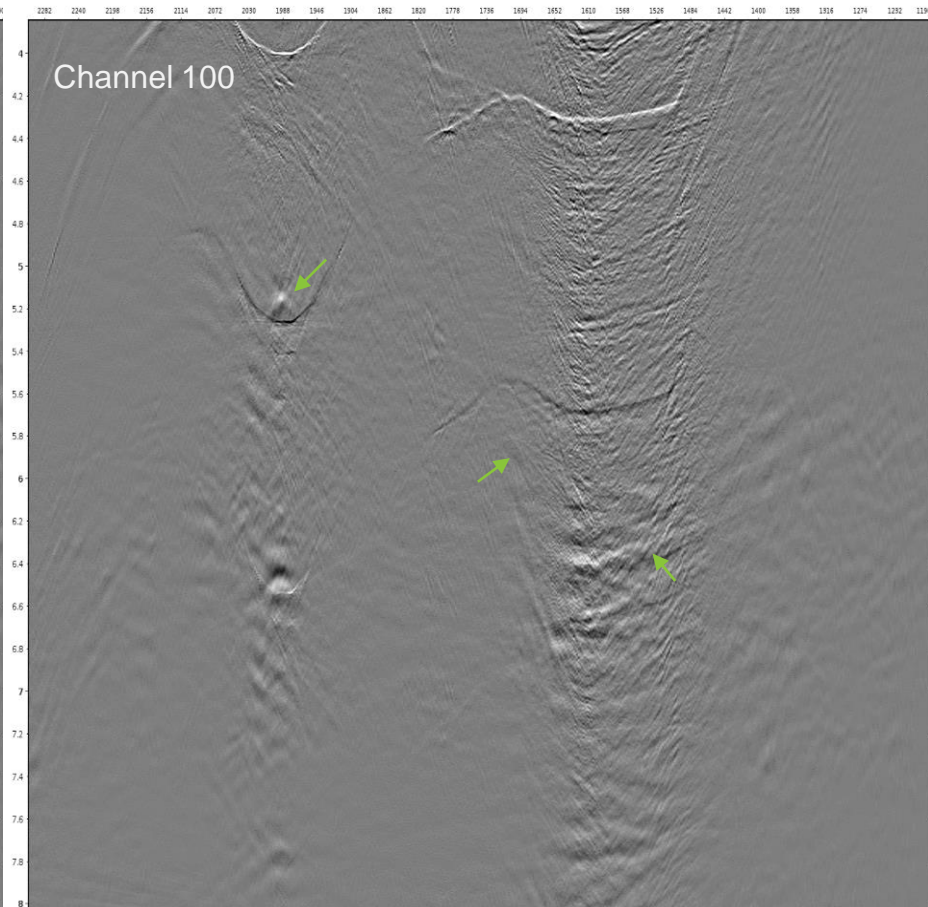
Difference before - after SRME Subtraction

34

CABTR 10 / NAVSHOT



CABTR 100 / NAVSHOT

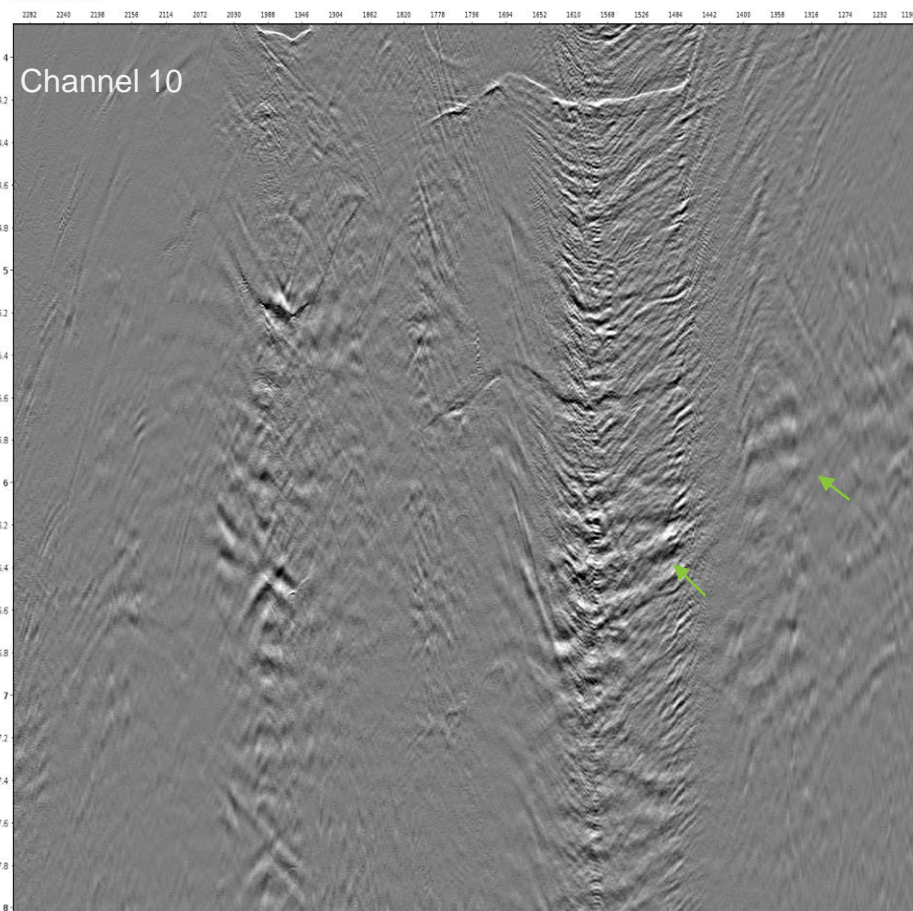




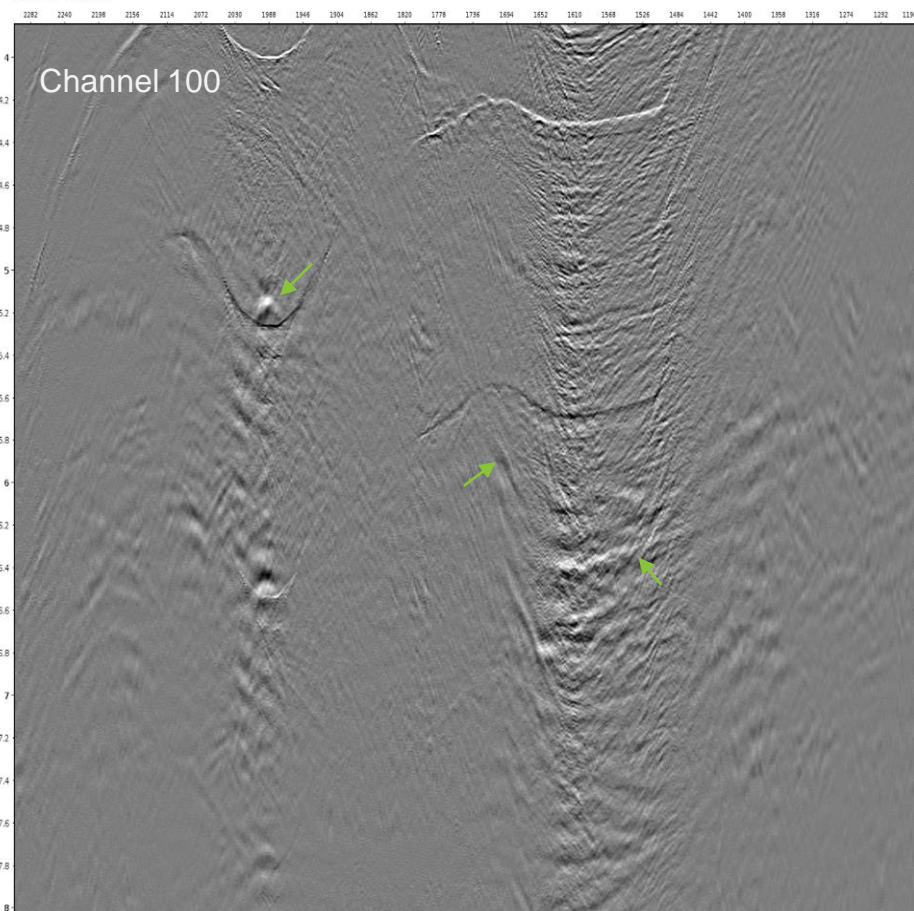
Difference before - after SRME & MWD Subtraction

35

CABTR 10 / NAVSHOT

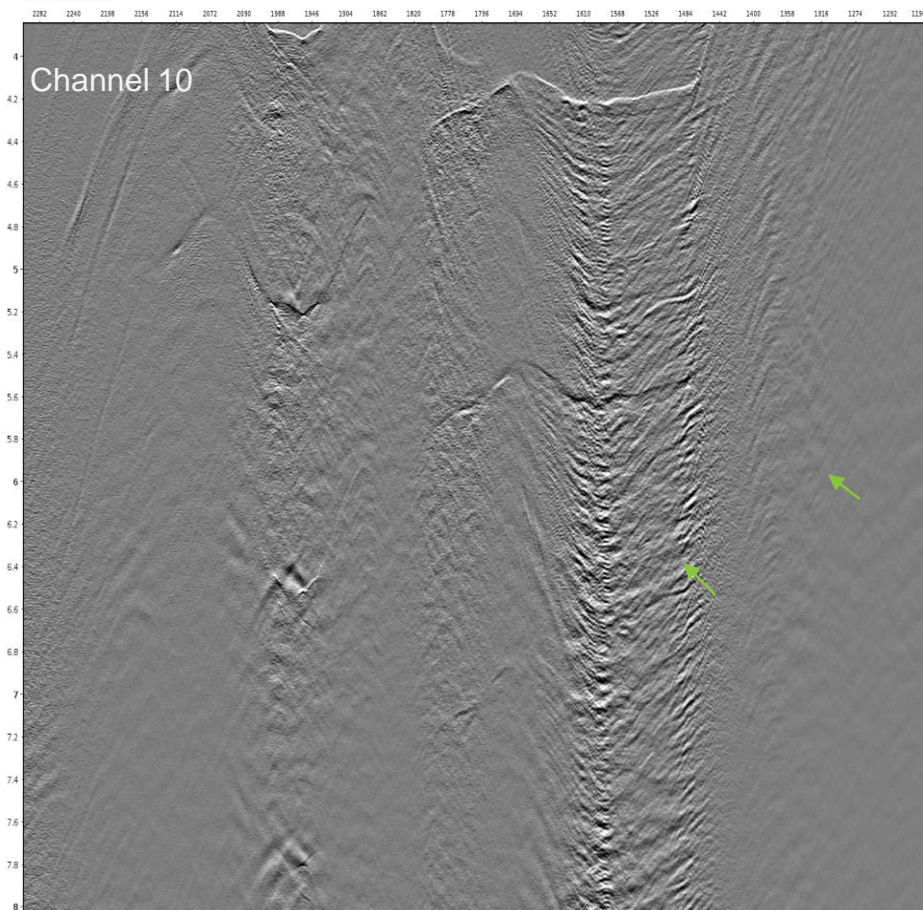


CABTR 100 / NAVSHOT

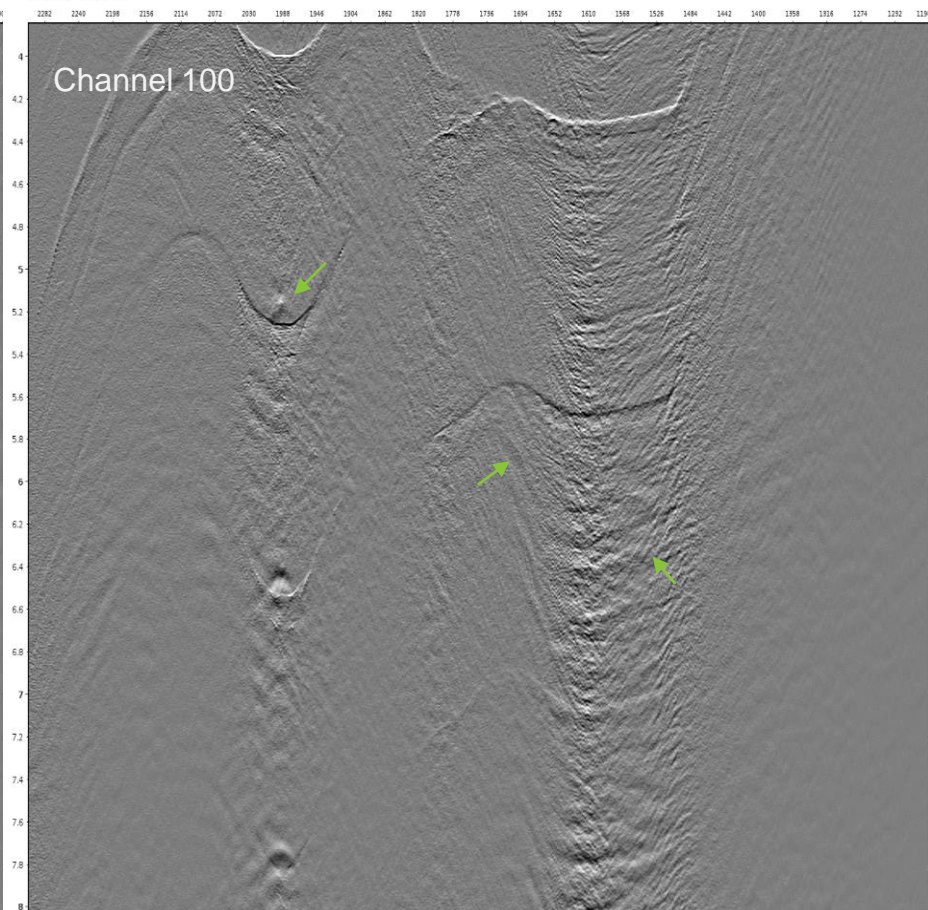




CABTR 10 / NAVSHOT

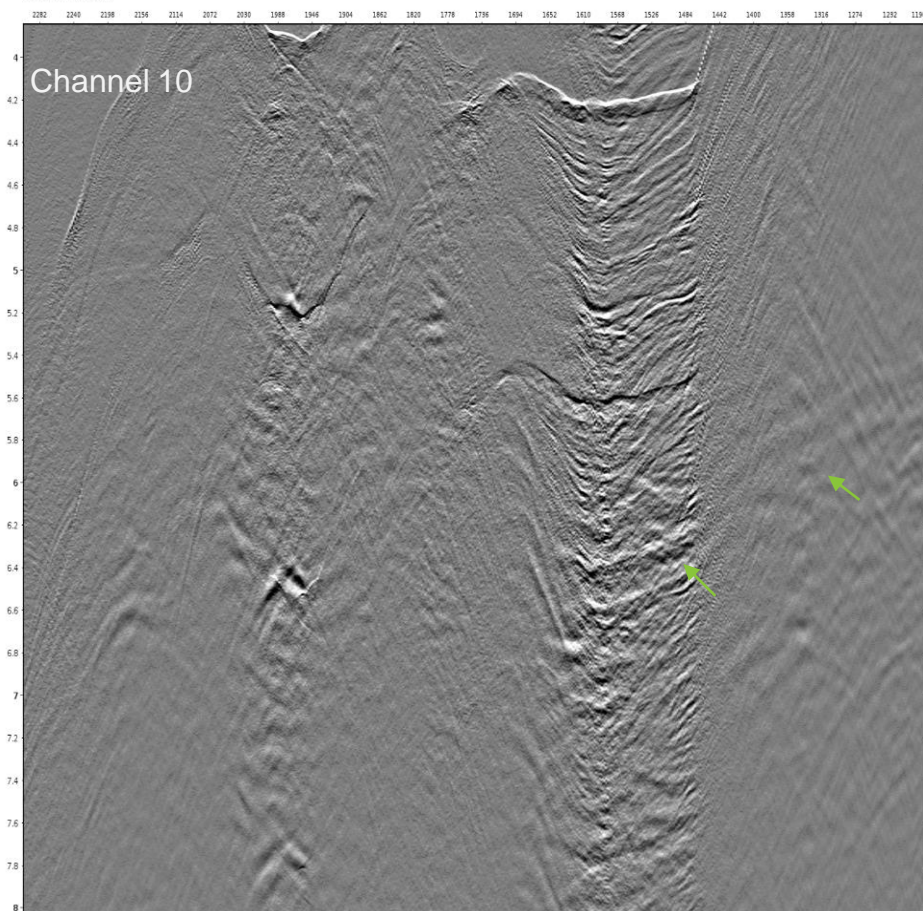


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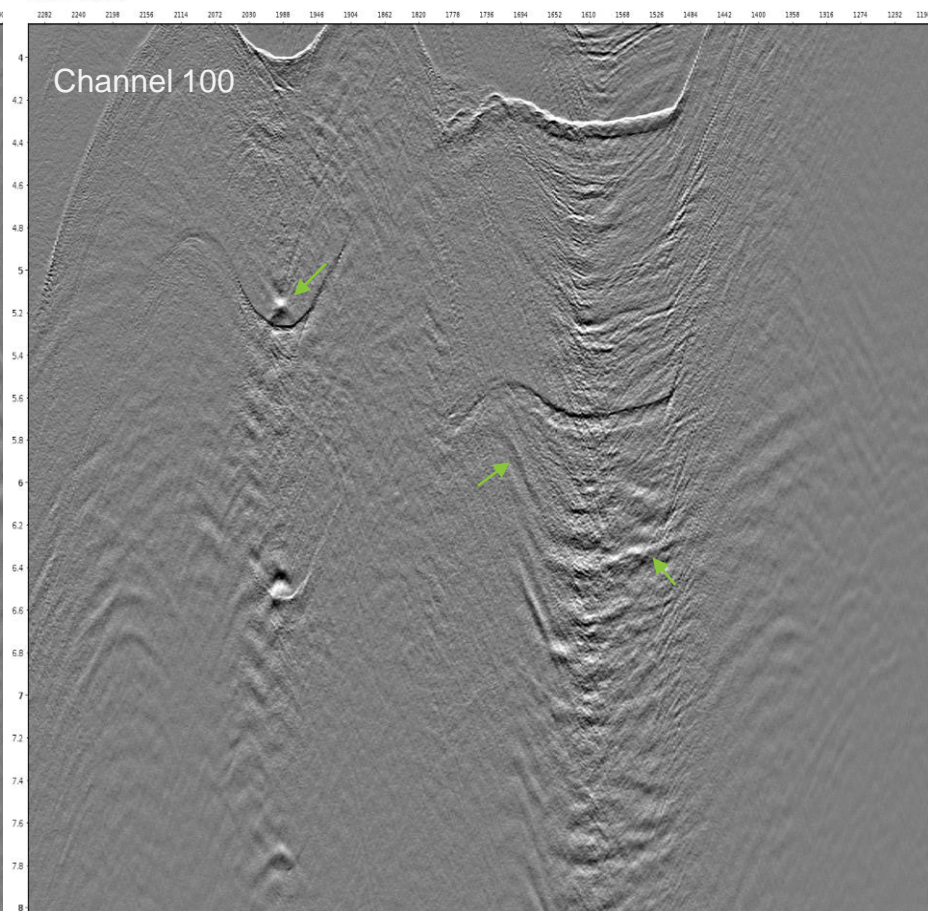




CABTR 10 / NAVSHOT



CABTR 100 / NAVSHOT



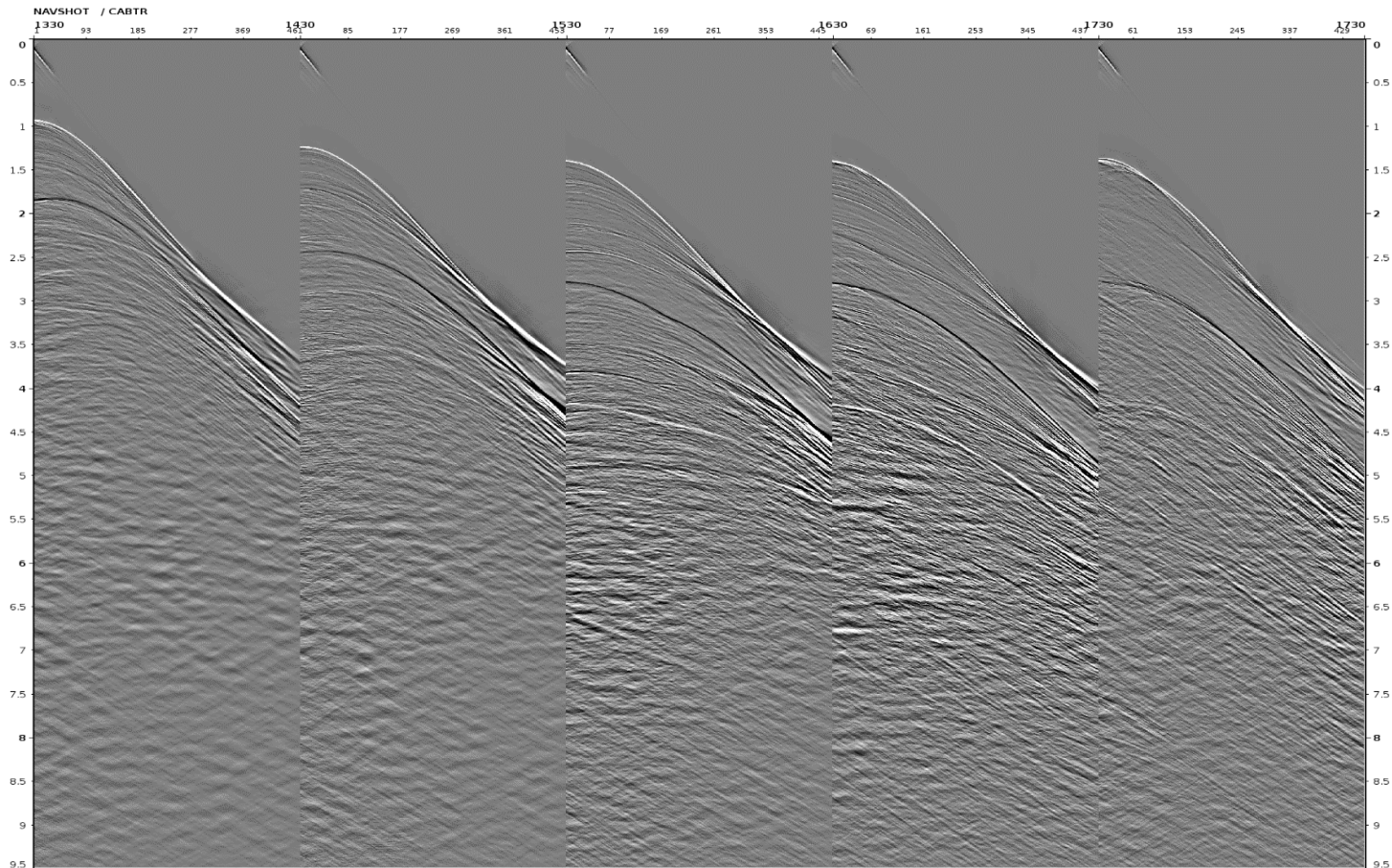
Seq 039

Stack

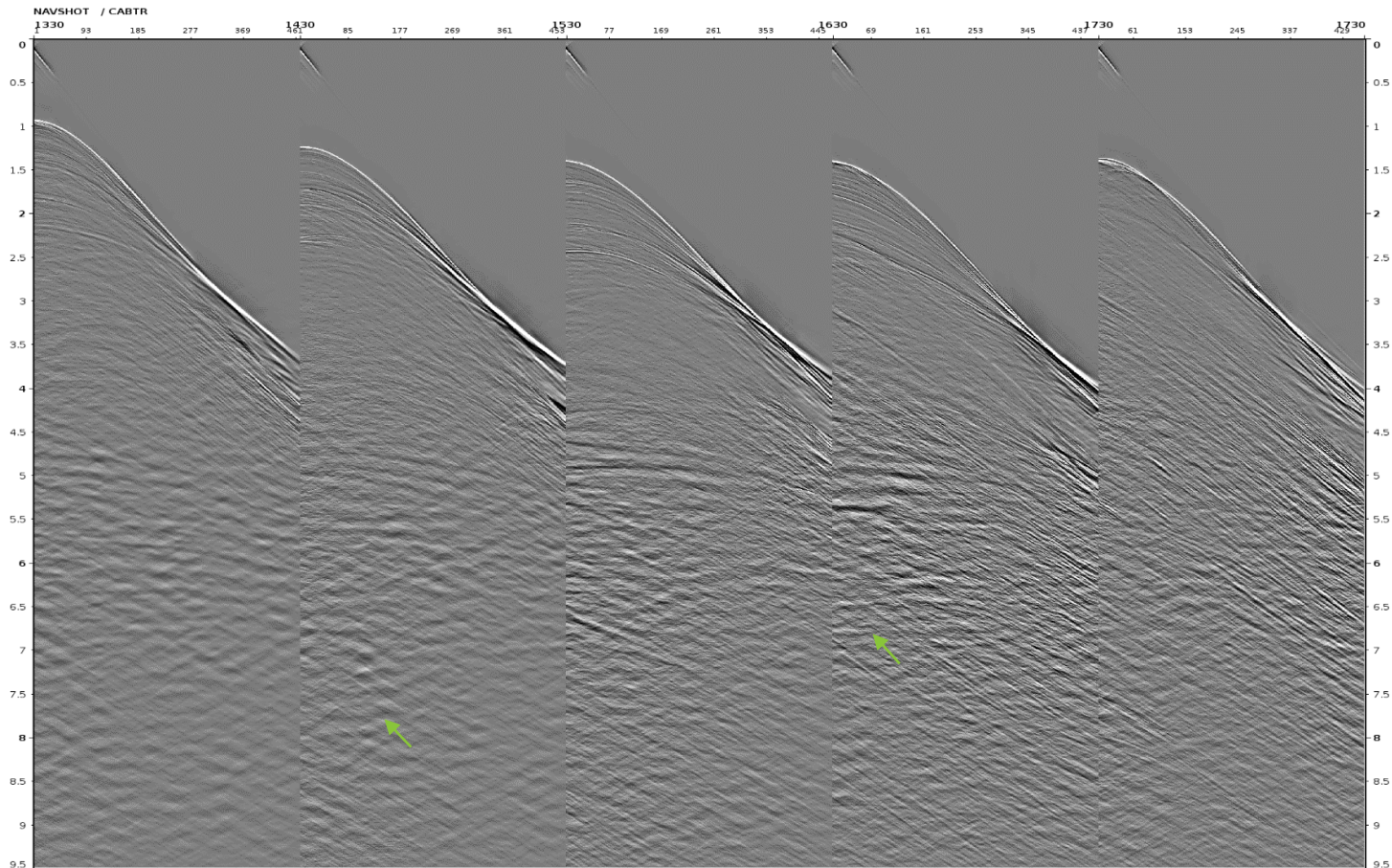
Common Channel

Shot Gathers





- Simultaneous subtraction flow with MWD & SRME shows benefits in surface related multiples removal and primaries protection.
- Far offset dipping residual will be further removed by “Radon” and residual LNA (Linear noise attenuation).

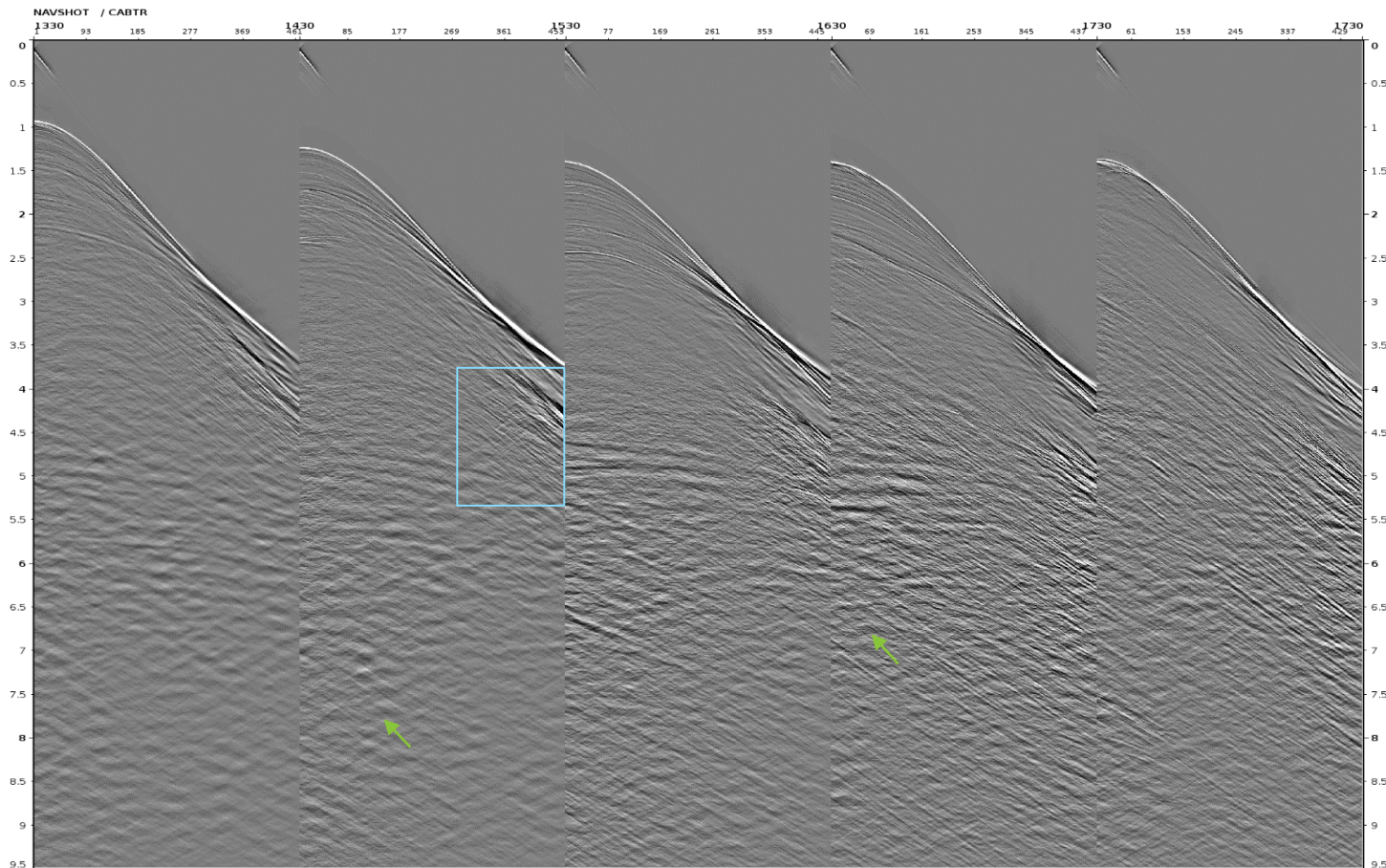


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- Far offset dipping residual will be further removed by “Radon” and residual LNA (Linear noise attenuation).



Selected Shots after SRME & MWD Subtraction

41

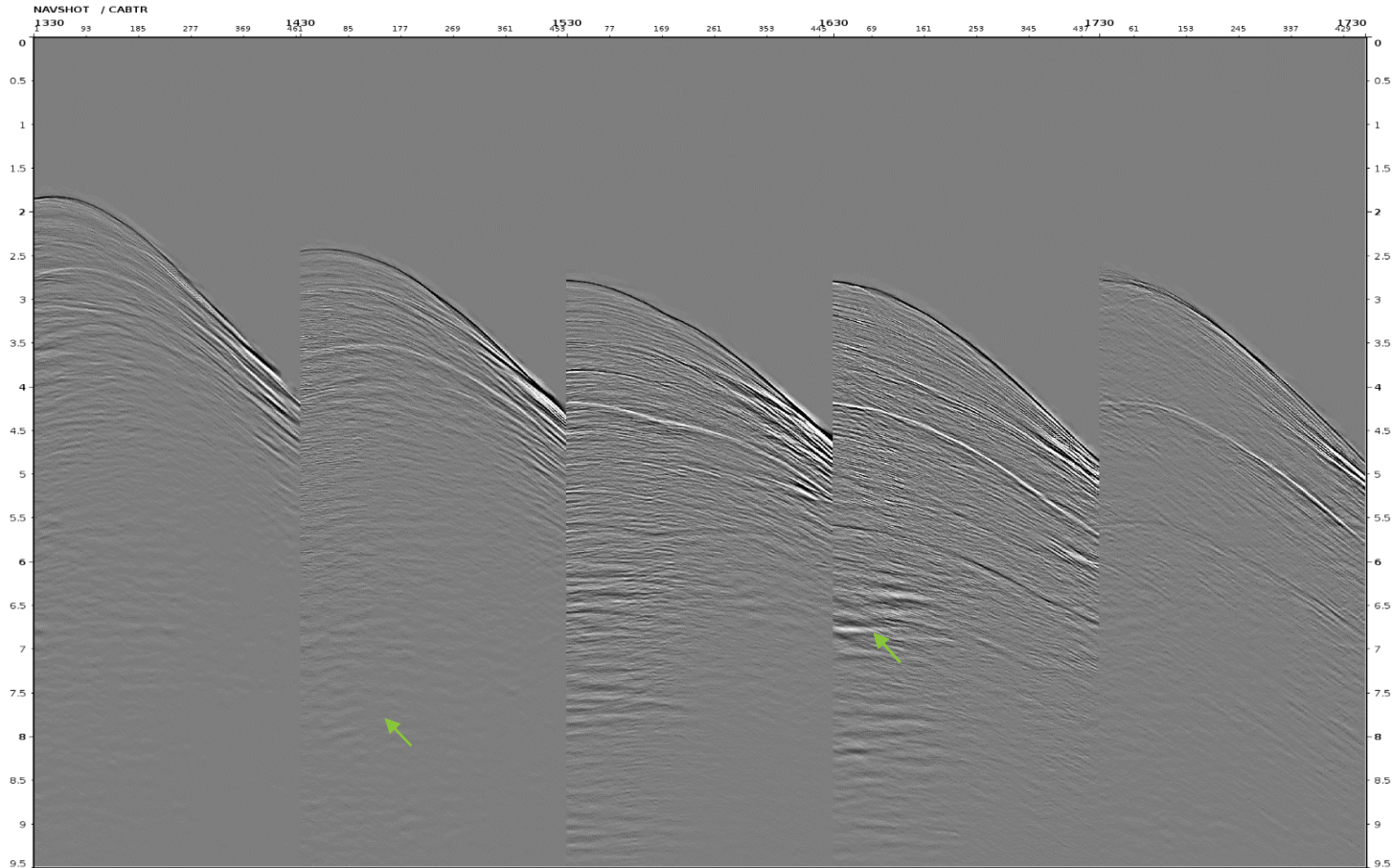


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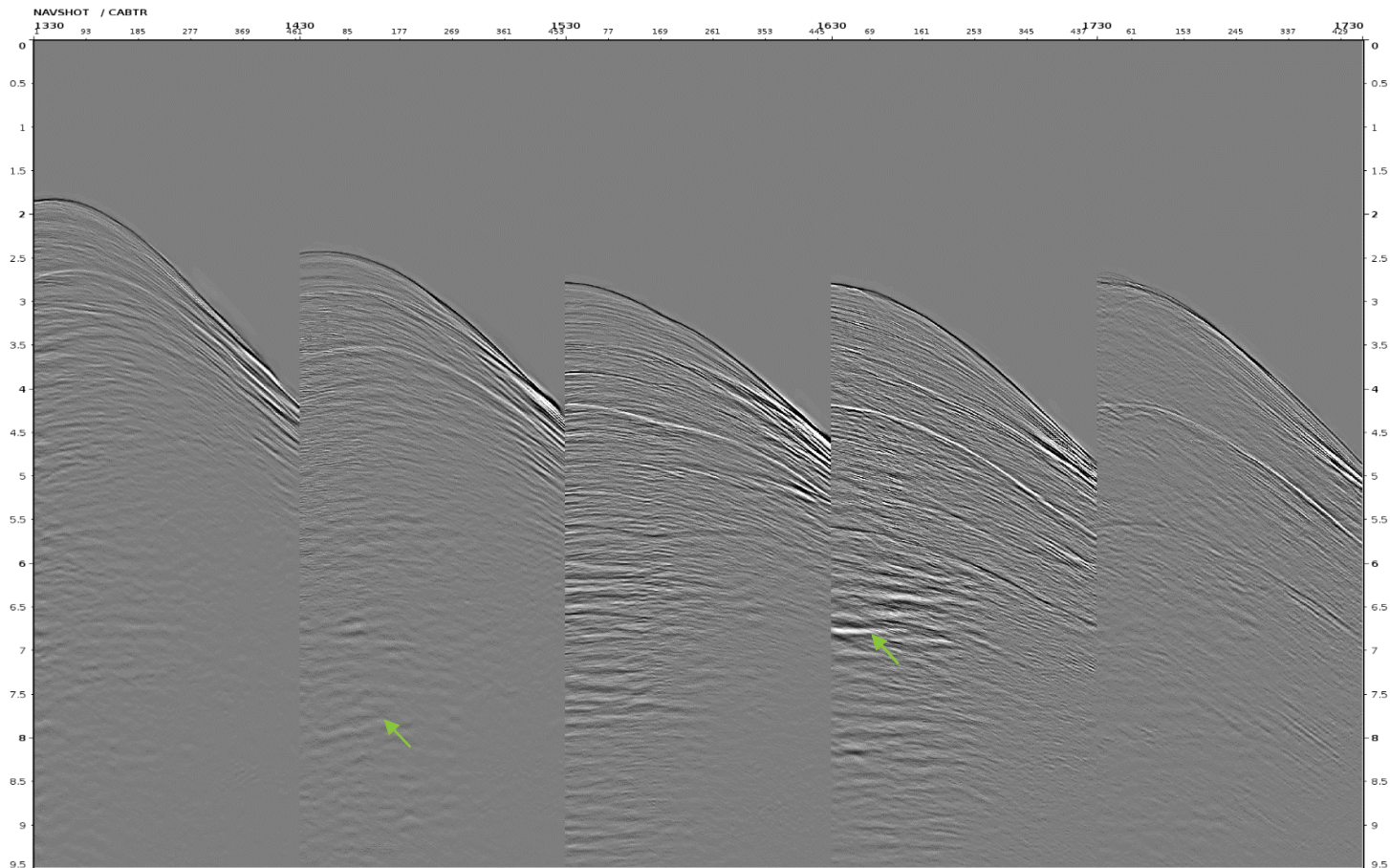


Difference before - after SRME Subtraction

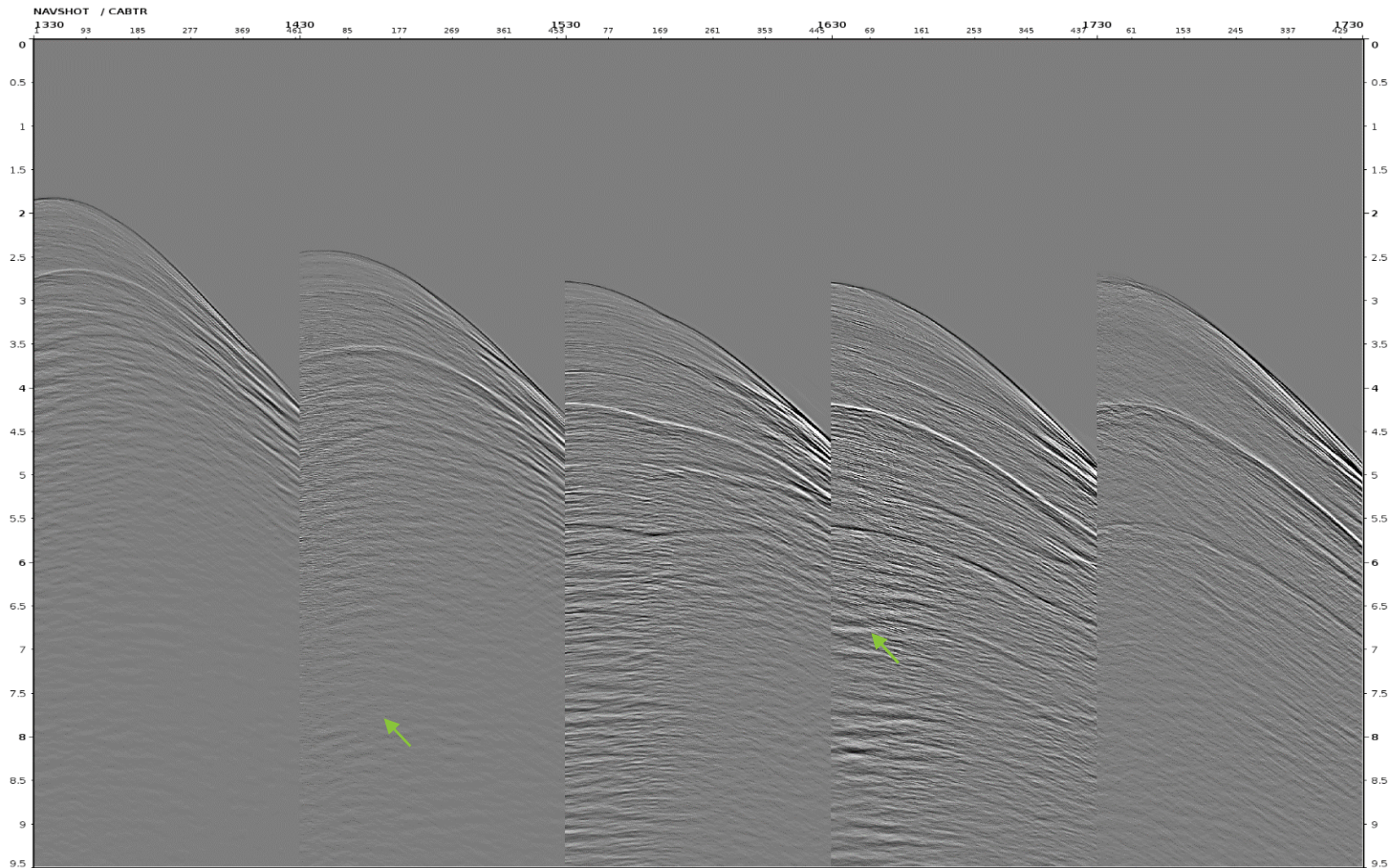
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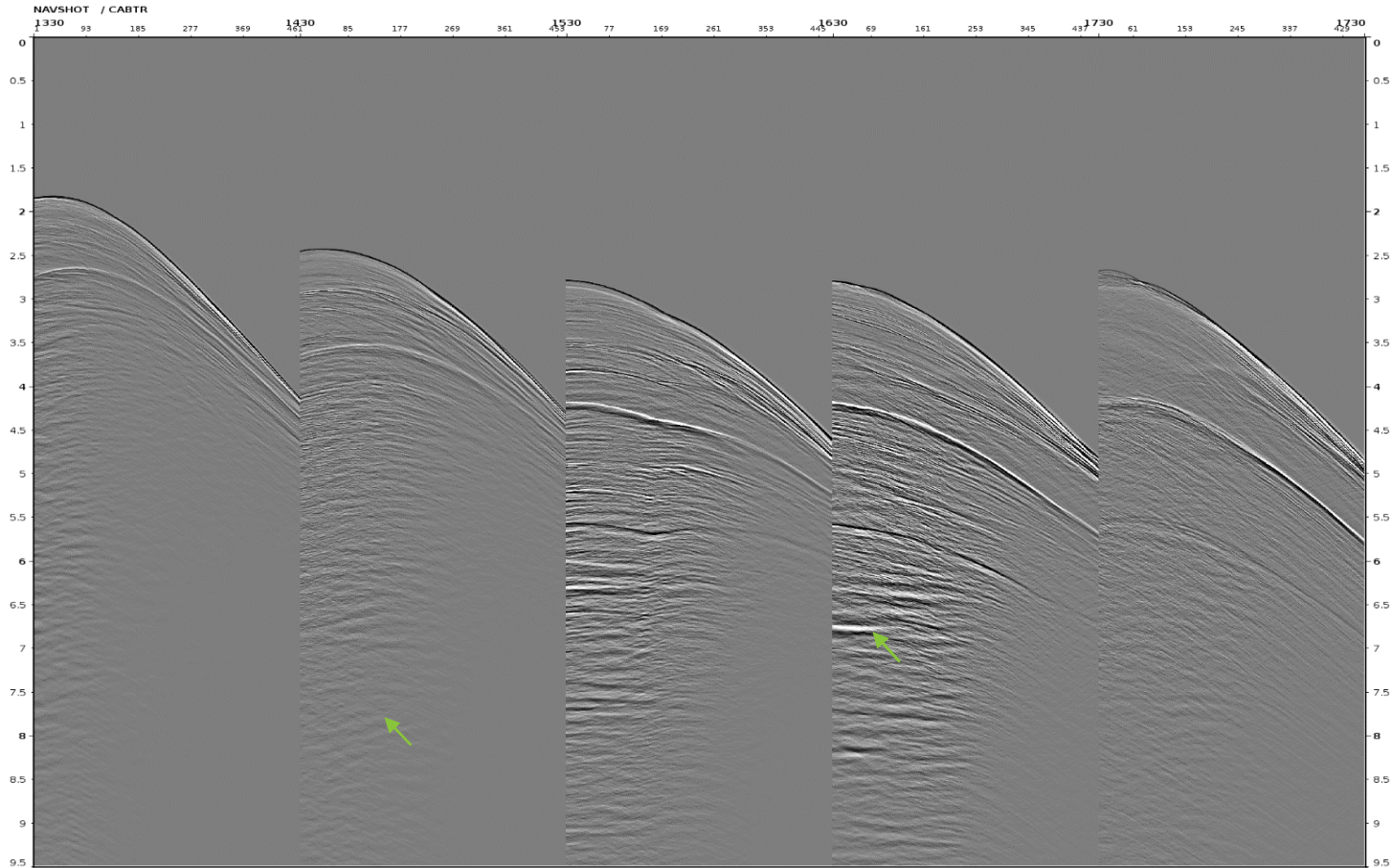
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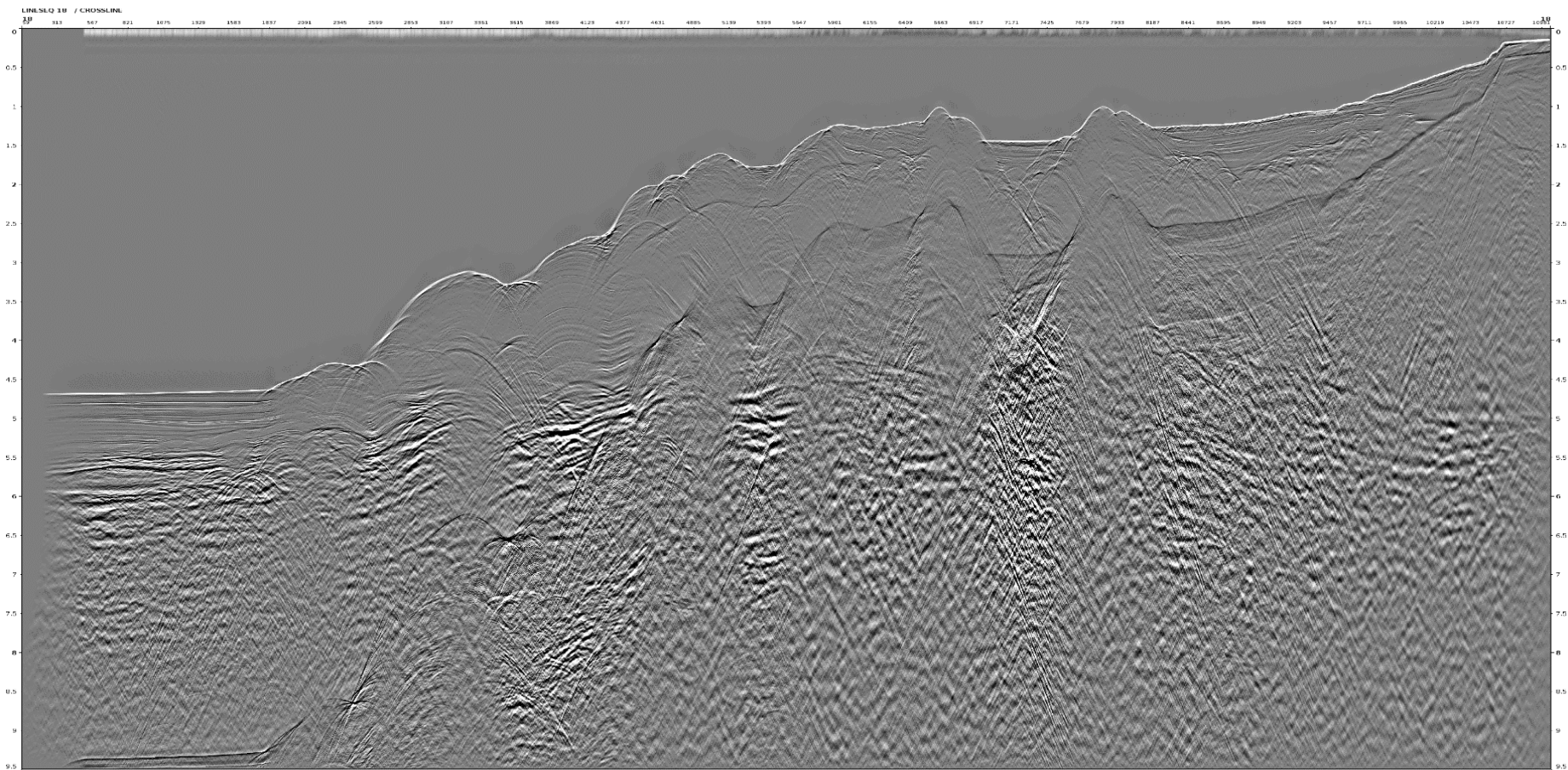
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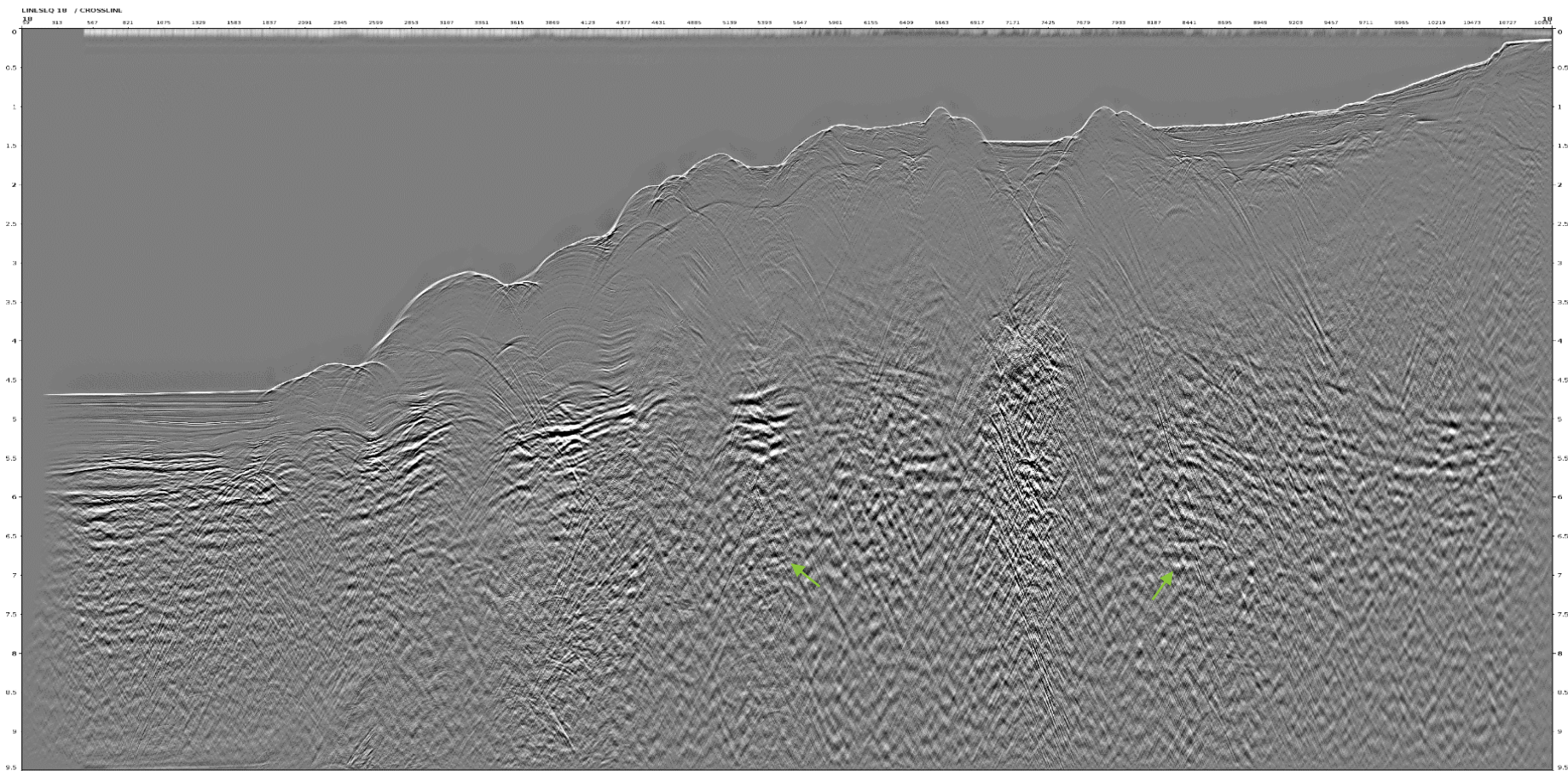
Stack

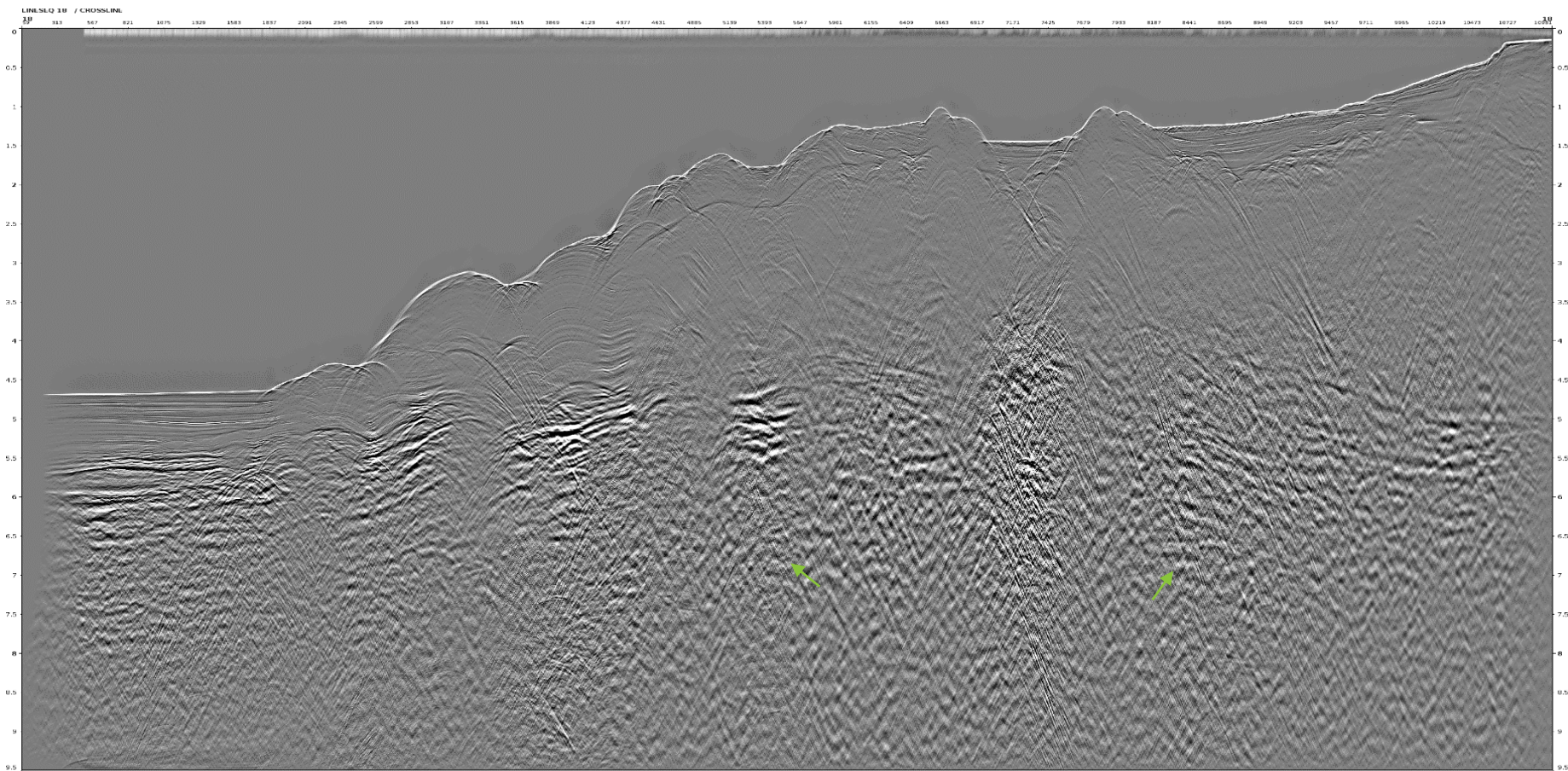
Common Channel

Shot Gathers







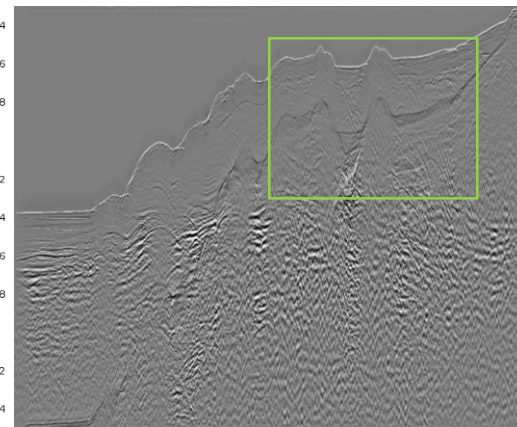
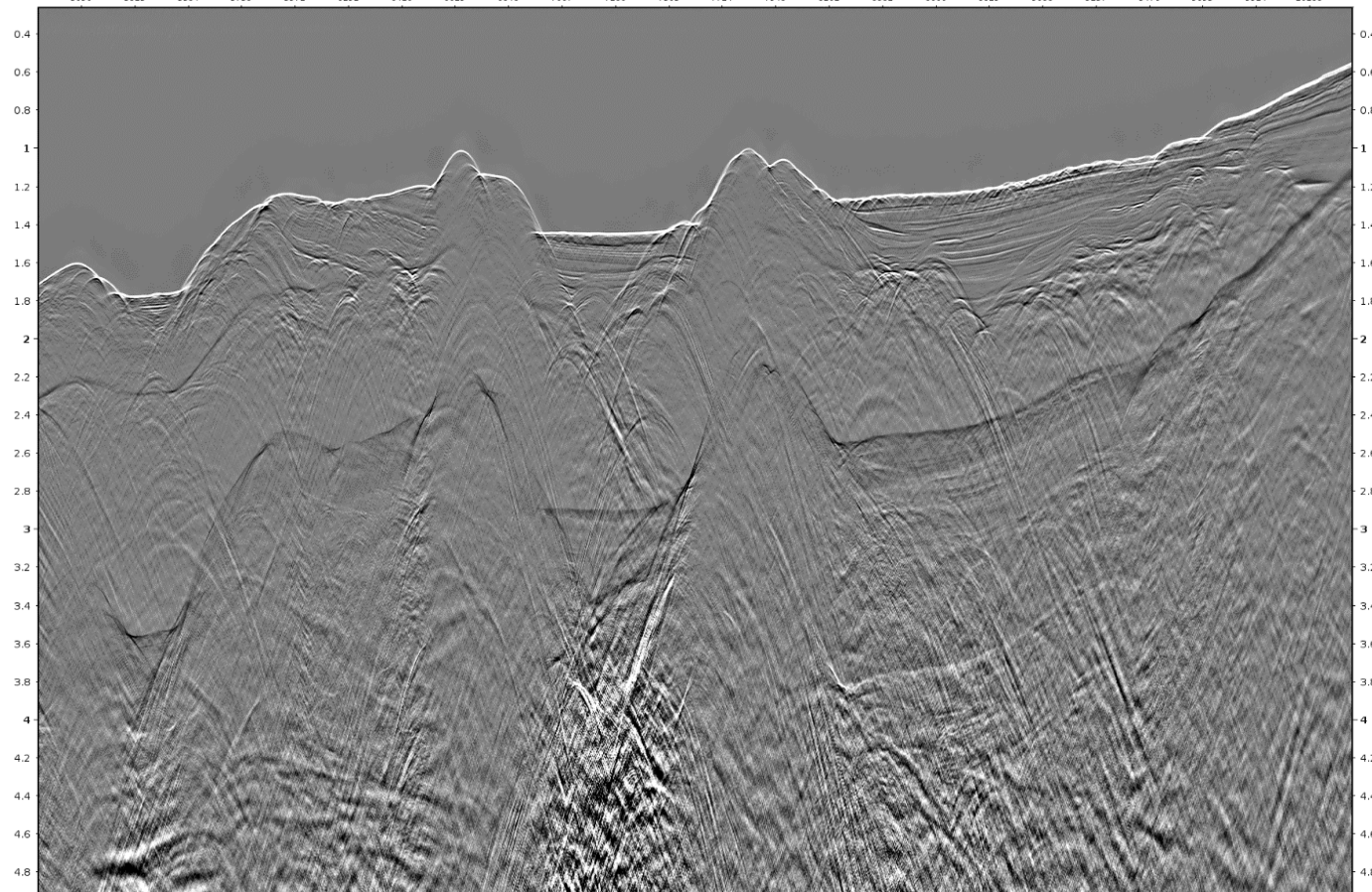


Zoom in Stack before Subtraction

50

LINESEQ 18 / CROSSLINE

5096 5315 5534 5753 5972 6191 6410 6629 6848 7067 7286 7505 7724 7943 8162 8381 8600 8819 9038 9257 9476 9695 9914 10133



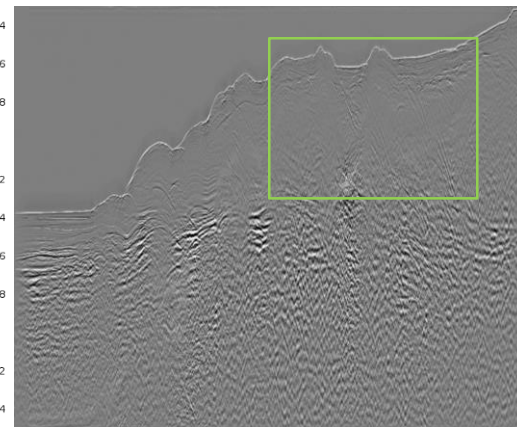
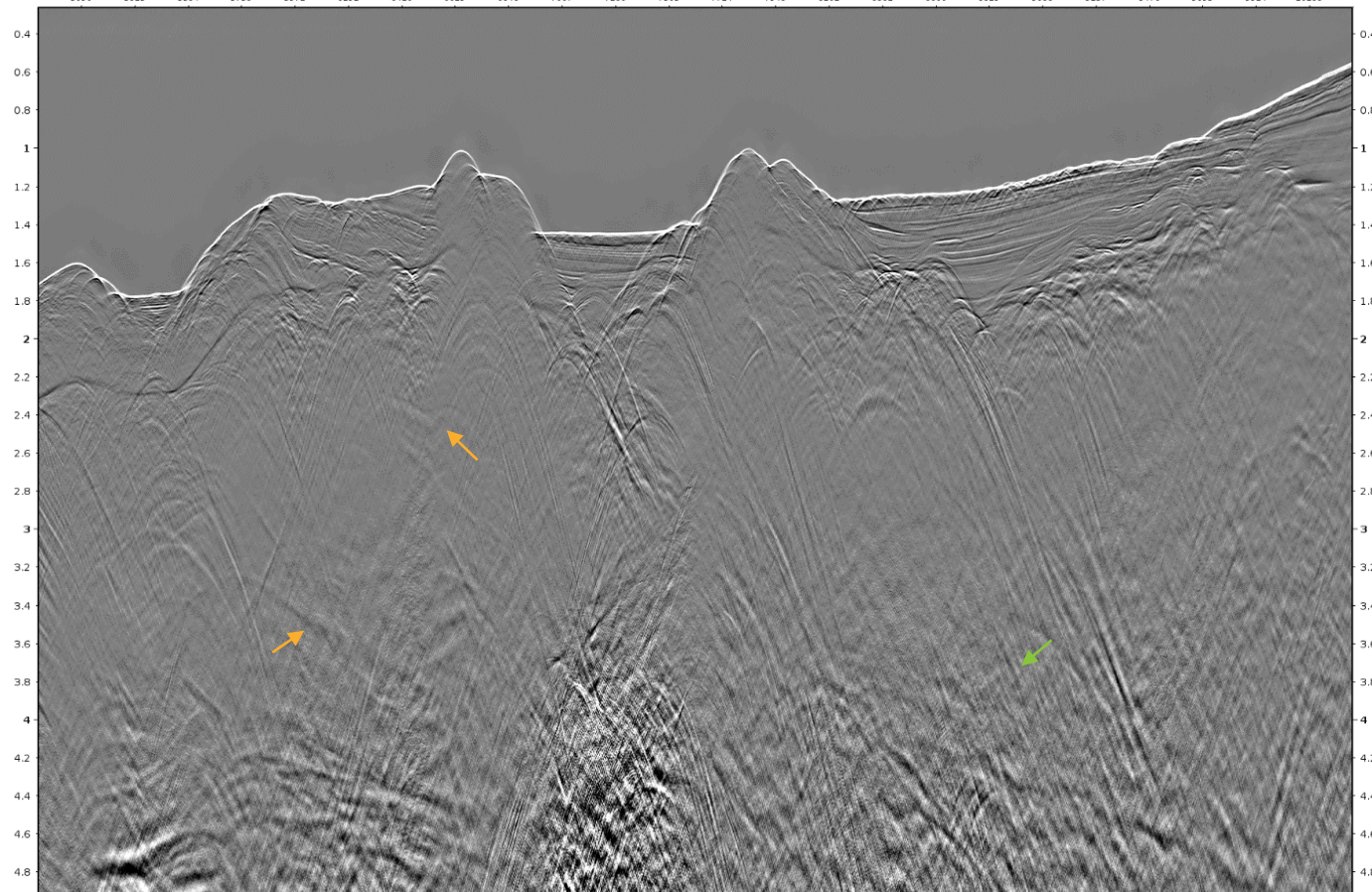
- Multiples are better attenuated with simultaneous subtraction.
- Primaries are protected by simultaneous subtraction flow.

Zoom in Stack after SRME Subtraction

51

LINESEQ 18 / CROSSLINE

5096 5315 5534 5753 5972 6191 6410 6629 6848 7067 7286 7505 7724 7943 8162 8381 8600 8819 9038 9257 9476 9695 9914 10133



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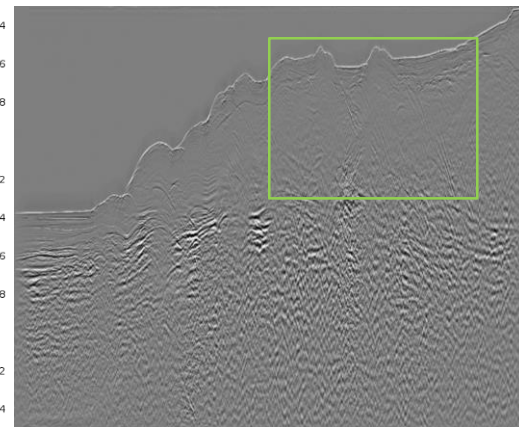
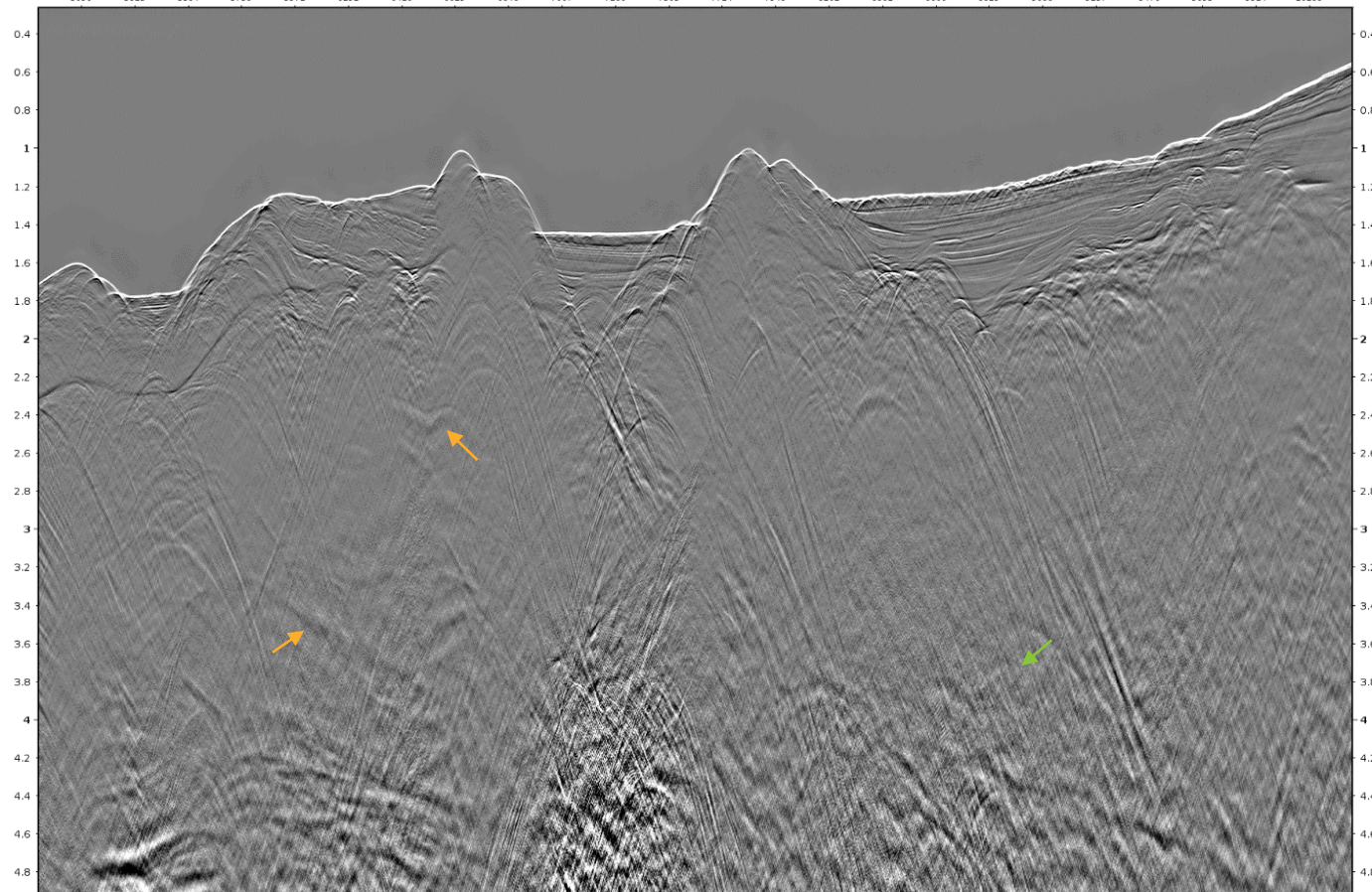


Zoom in Stack after SRME & MWD Subtraction

52

LINESEQ 18 / CROSSLINE

5096 5315 5534 5753 5972 6191 6410 6629 6848 7067 7286 7505 7724 7943 8162 8381 8600 8819 9038 9257 9476 9695 9914 10133



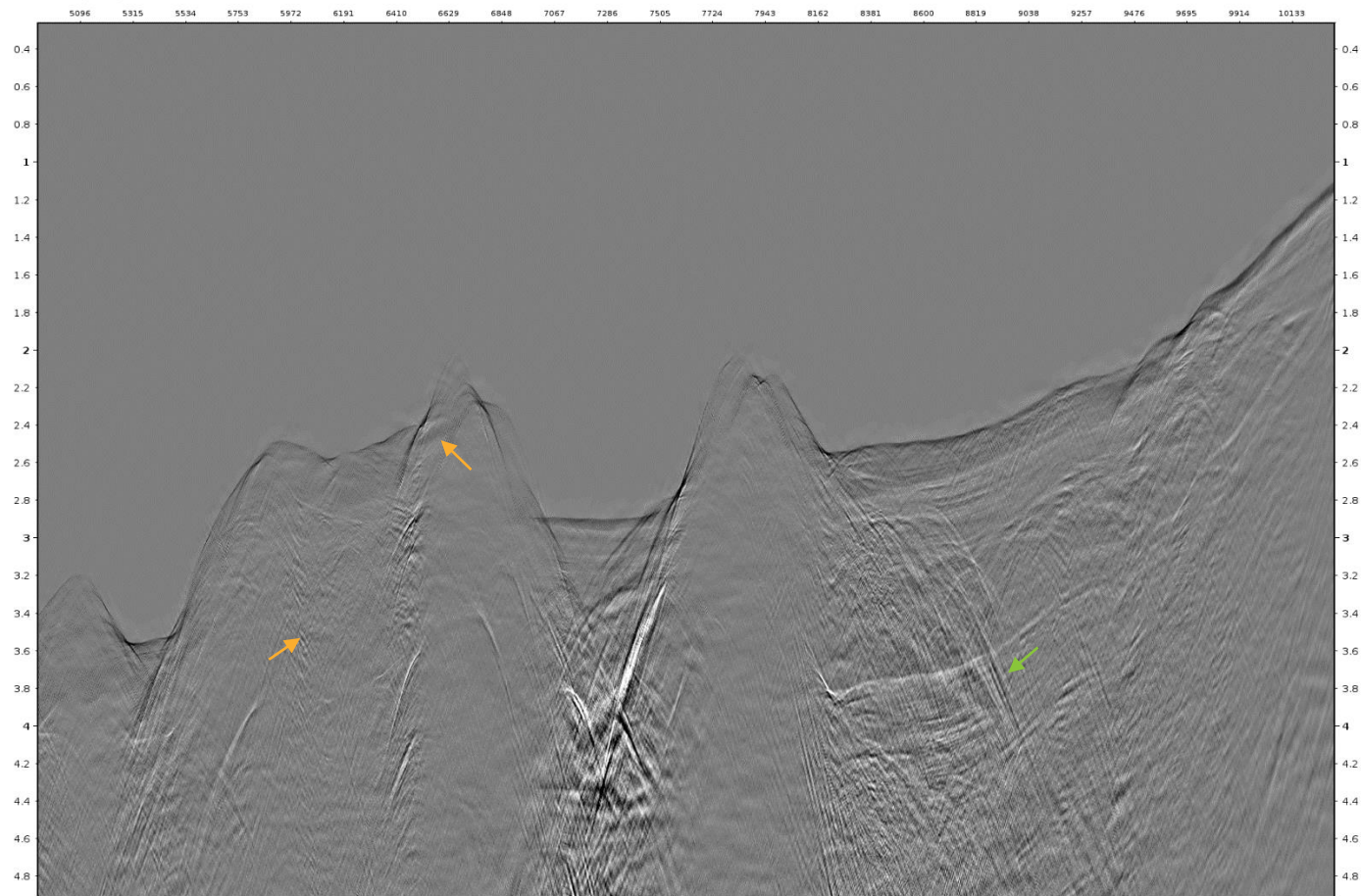
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Difference before – after SRME Subtraction

53

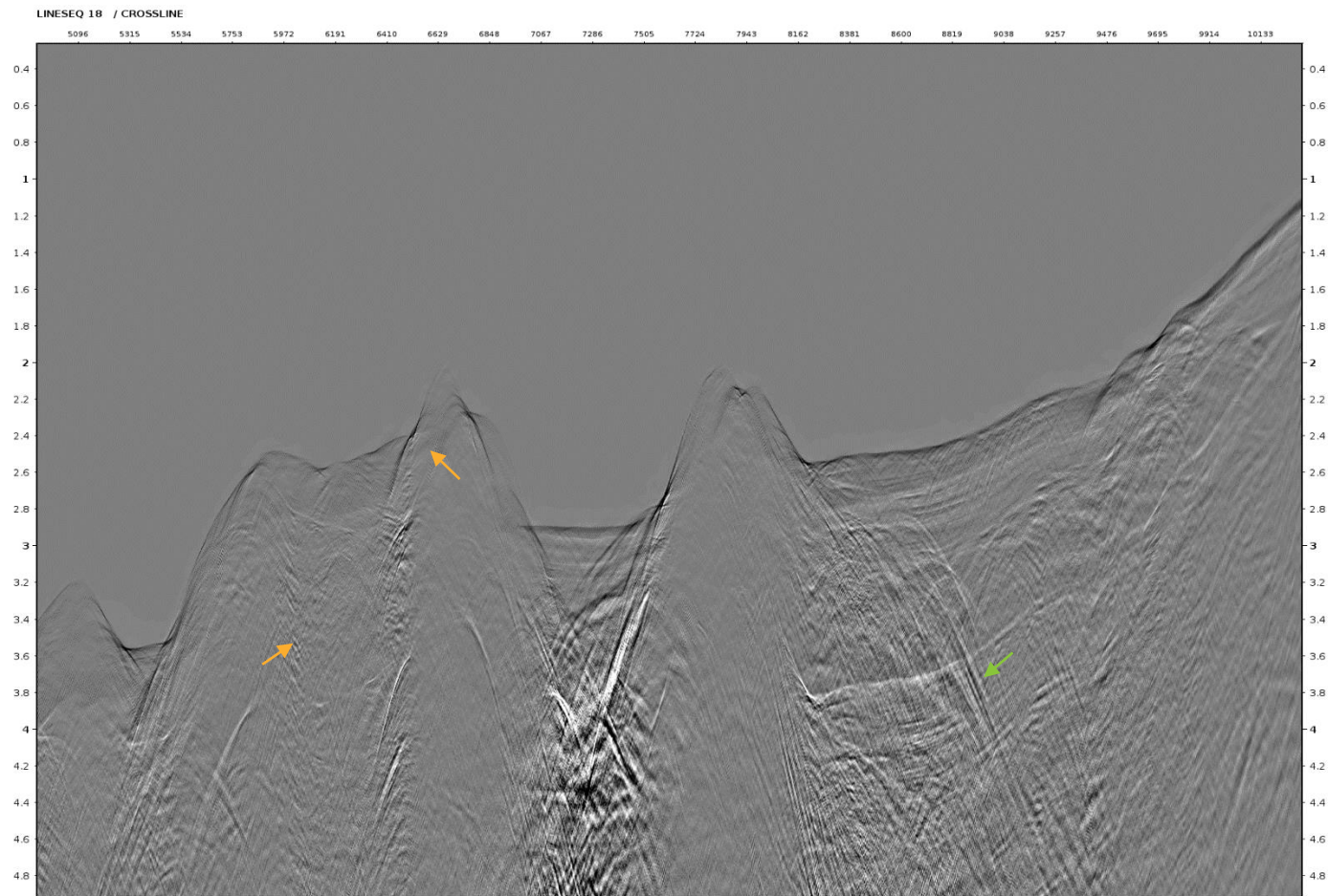
LINESEQ 18 / CROSSLINE





Difference before – after SRME & MWD Subtraction

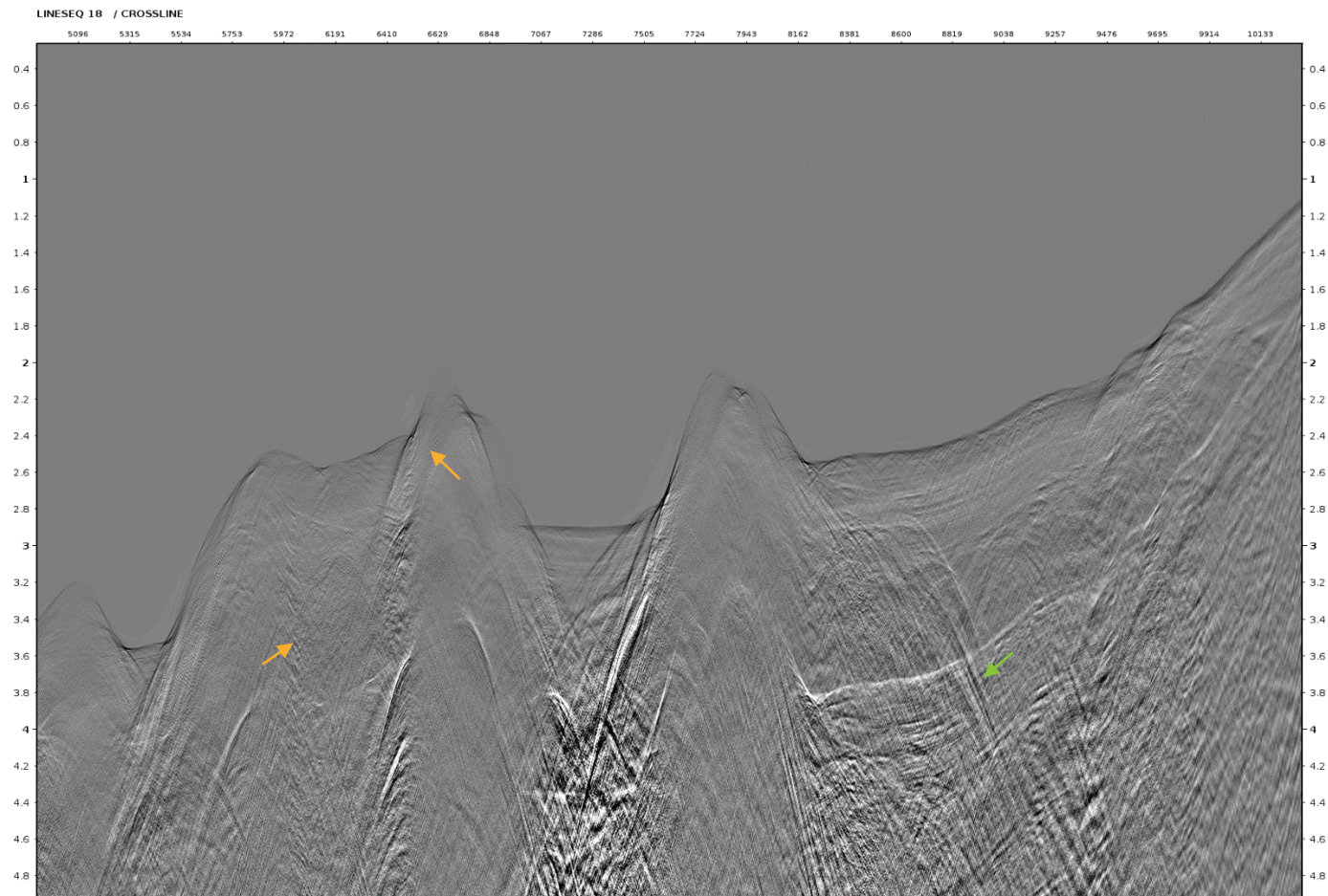
54

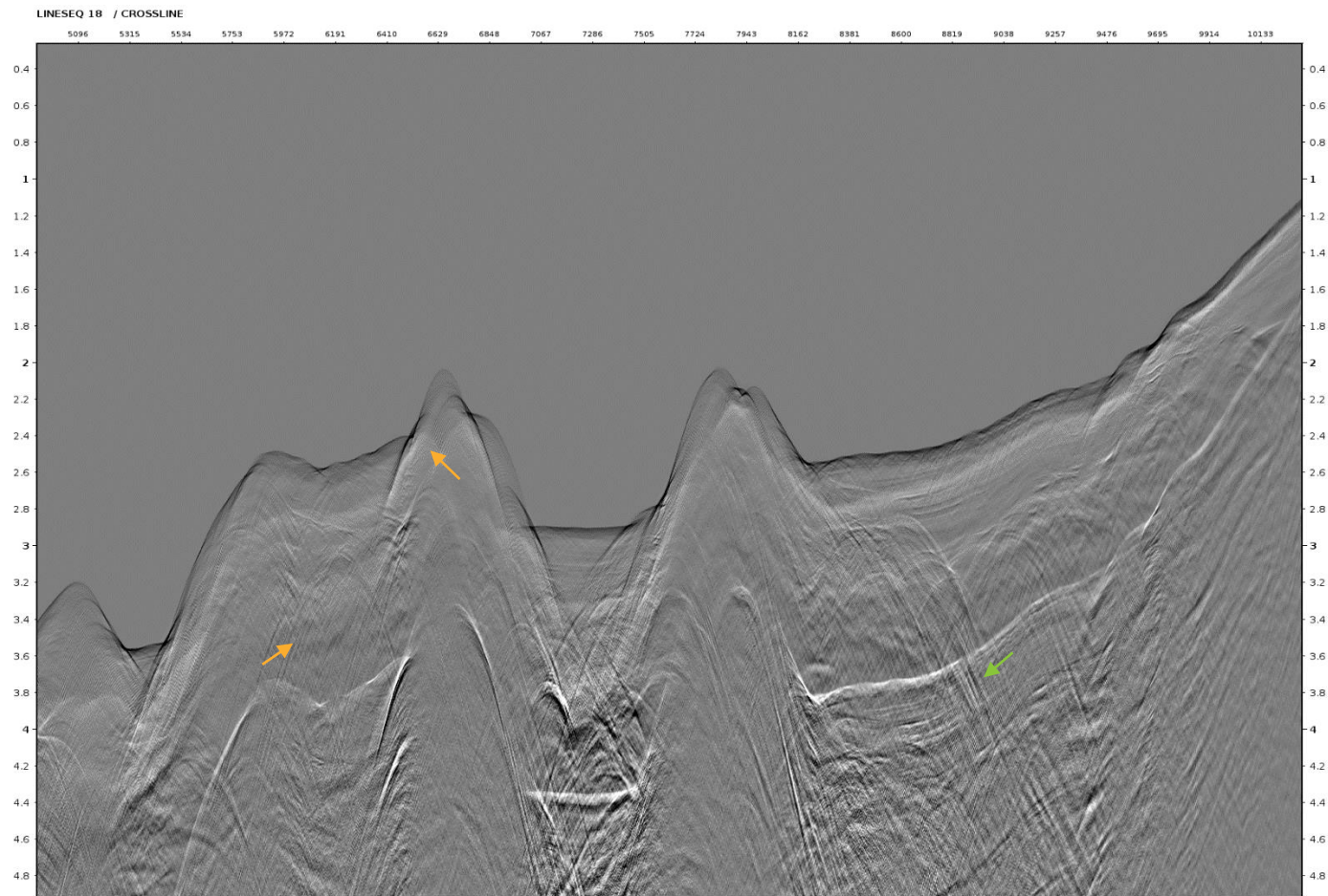




Zoom in Stack – SRME Model

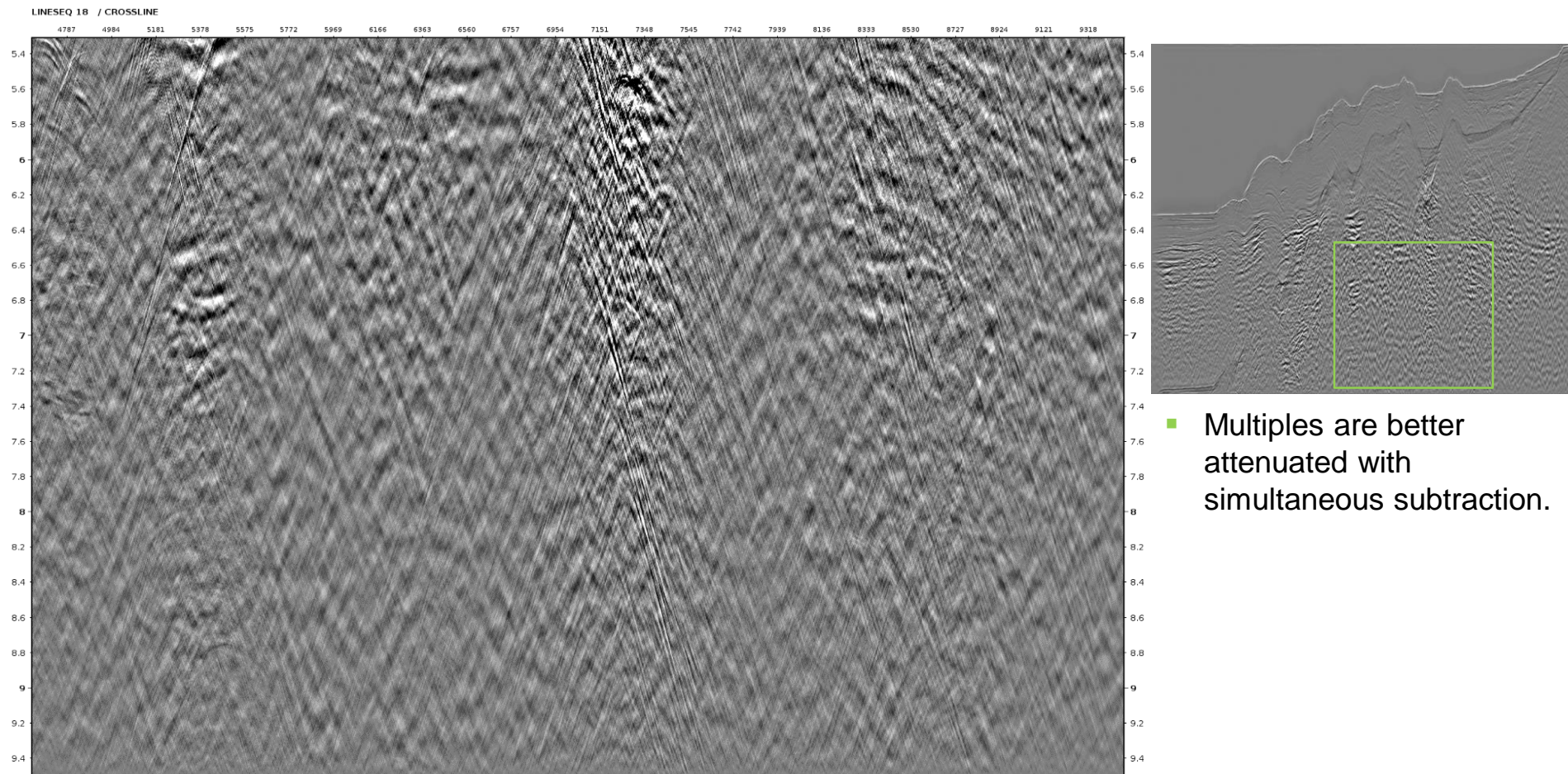
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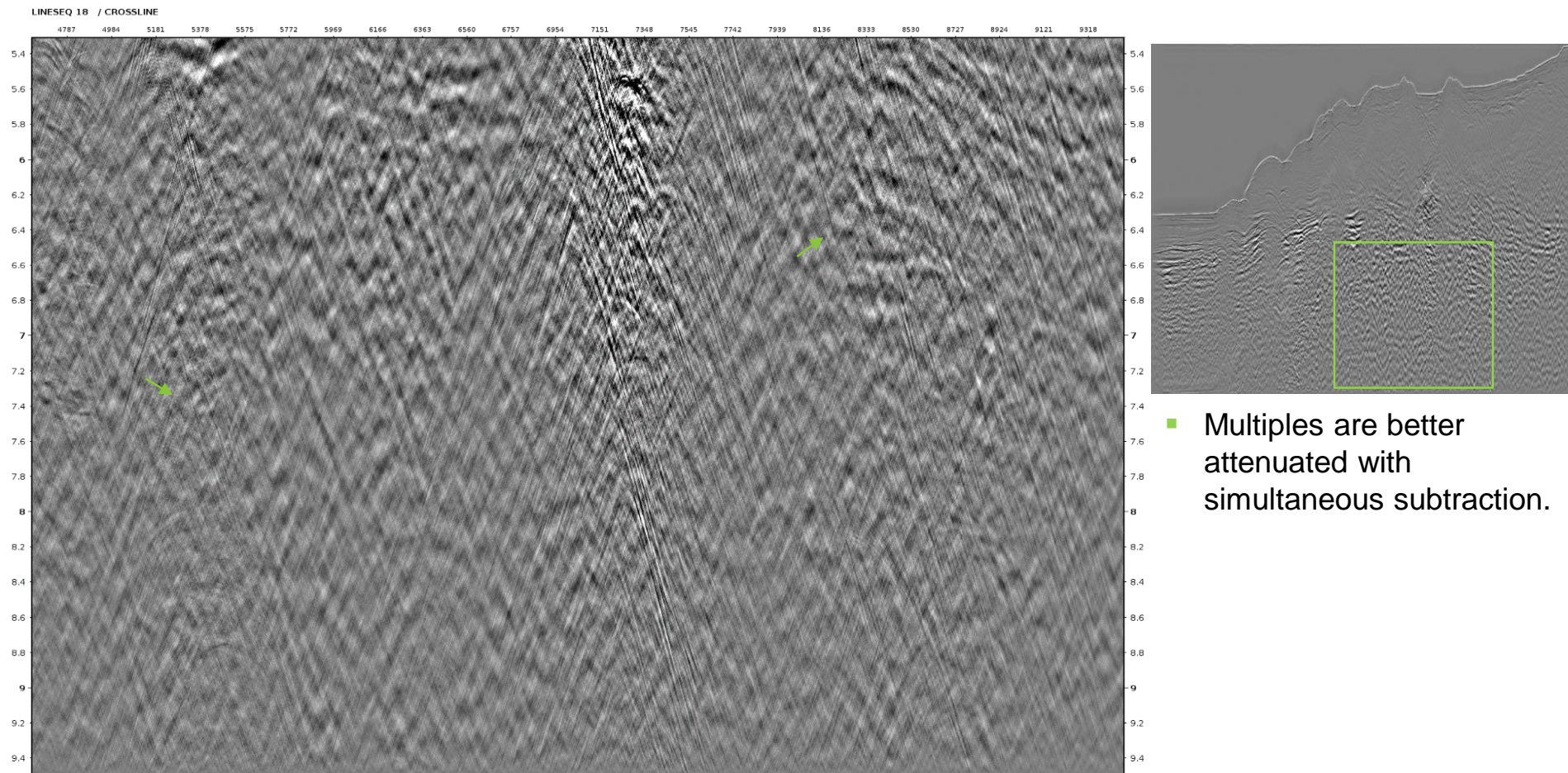
Zoom in Stack before Subtraction

57



Zoom in Stack after SRME Subtraction

58



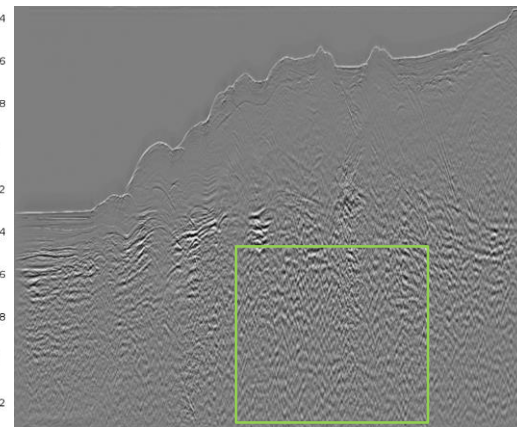
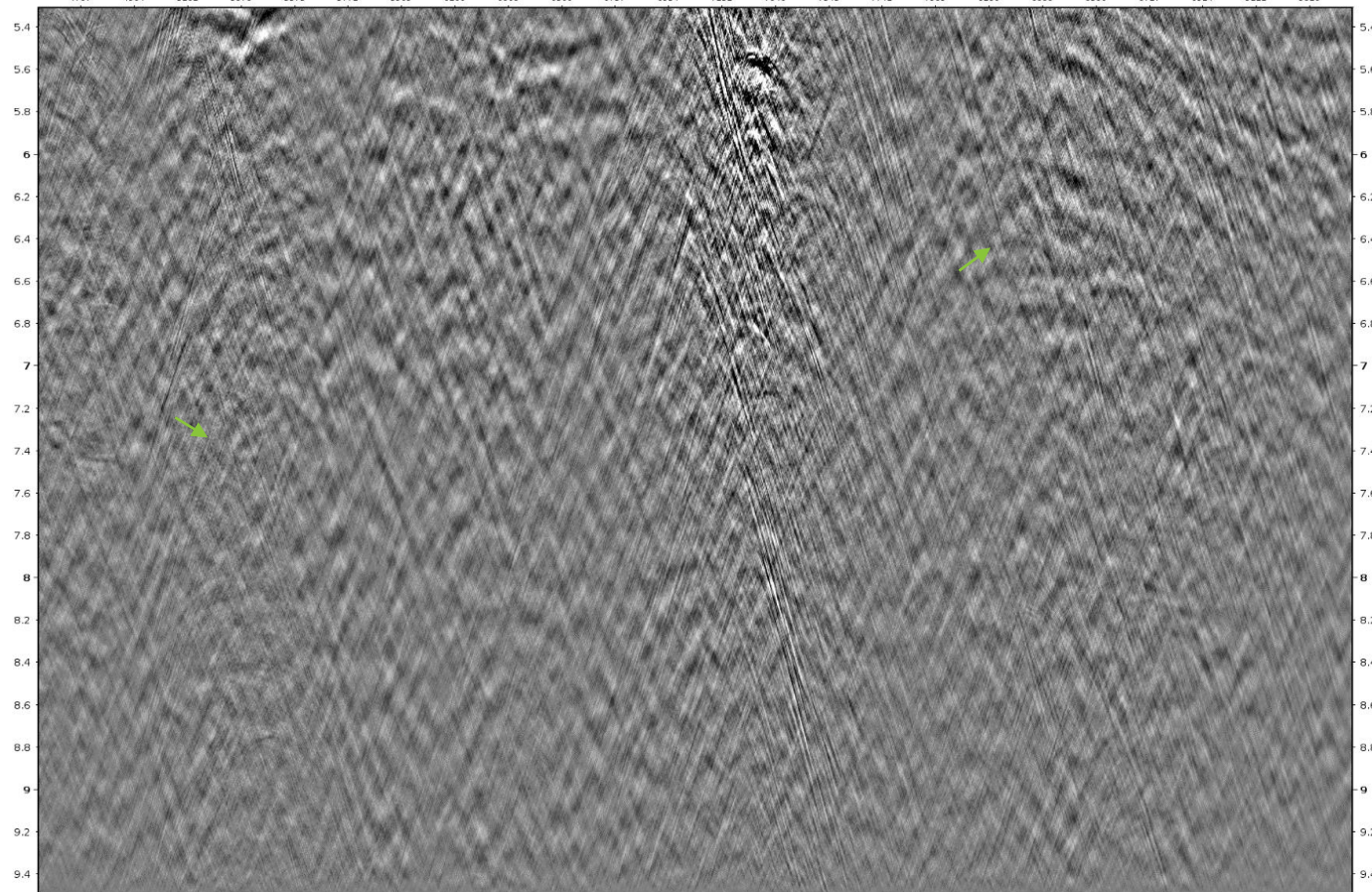


Zoom in Stack **after** SRME & MWD Subtraction

59

LINESEQ 18 / CROSSLINE

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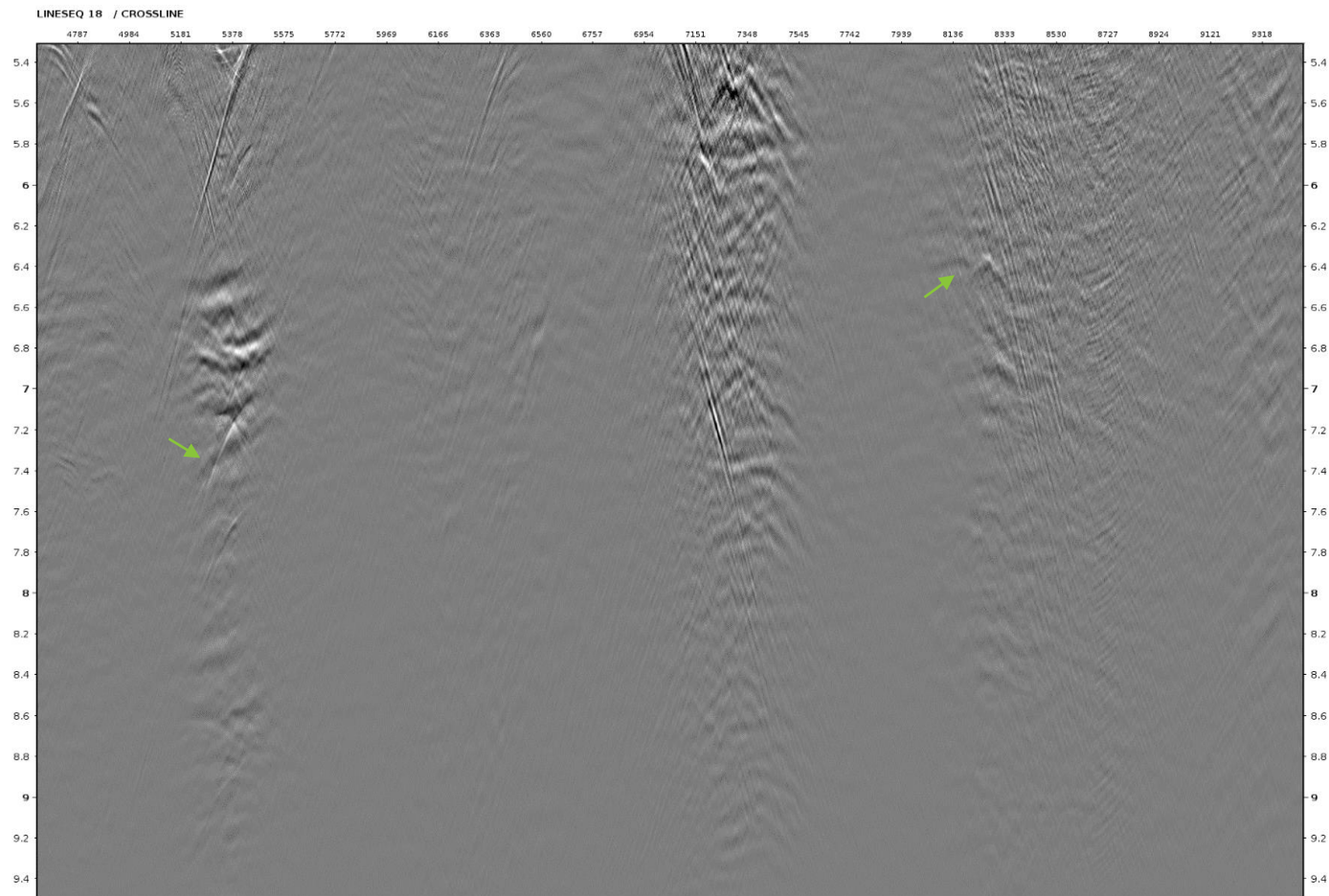


- Multiples are better attenuated with simultaneous subtraction.



Difference before – after SRME Subtraction

60

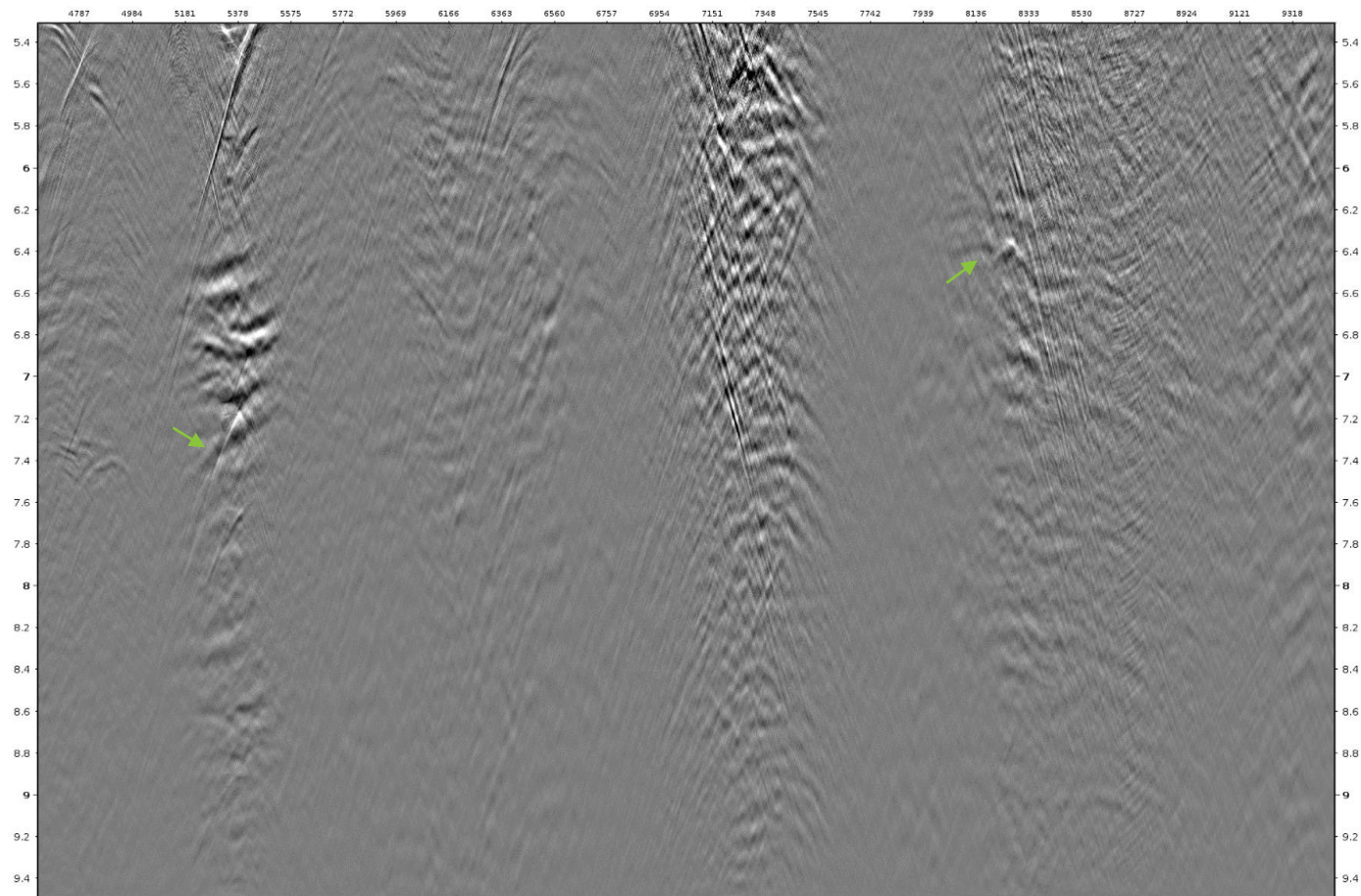




Difference before – after SRME & MWD Subtraction

61

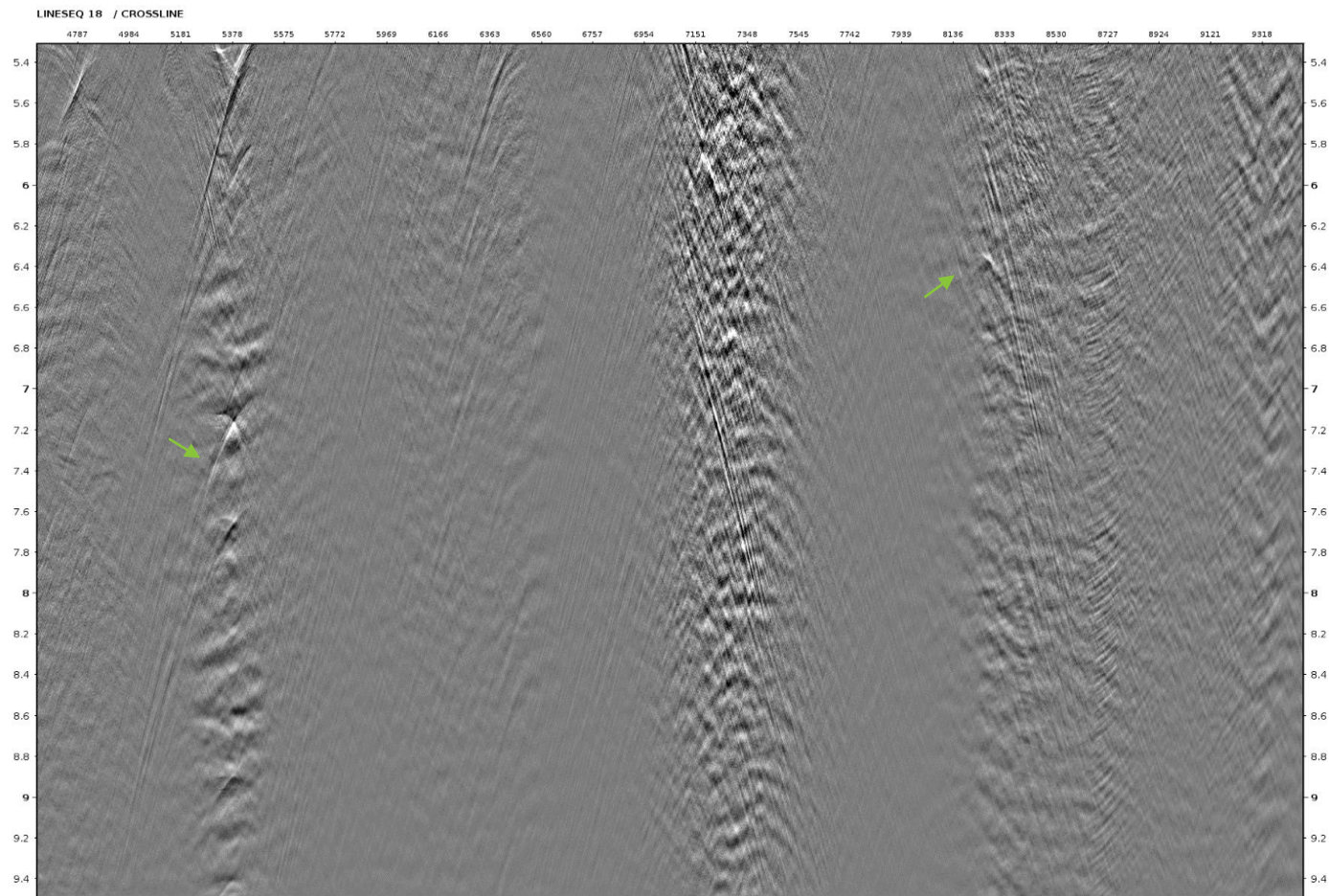
LINESEQ 18 / CROSSLINE





Zoom in Stack – SRME Model

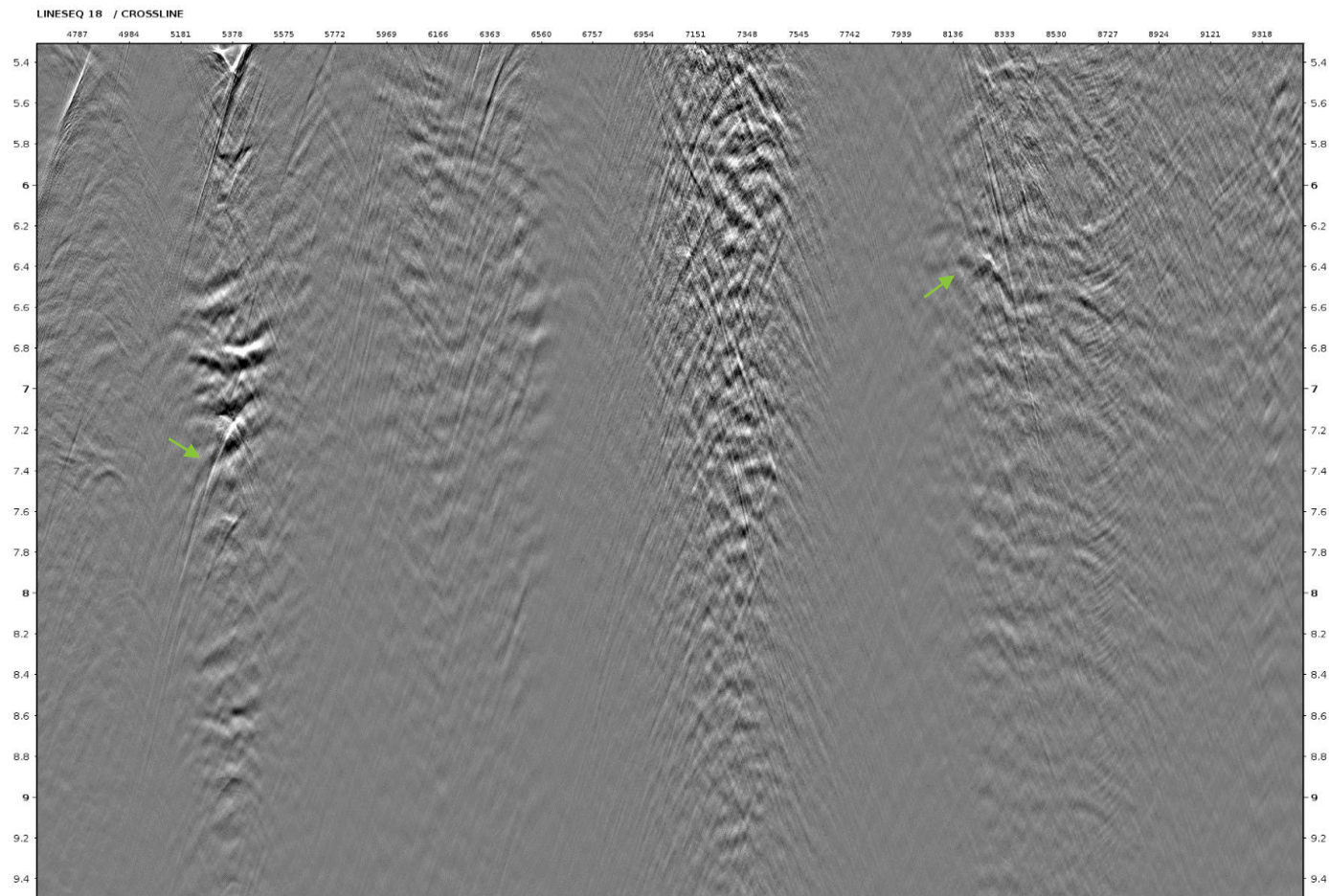
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Zoom in Stack – MWD Model

63

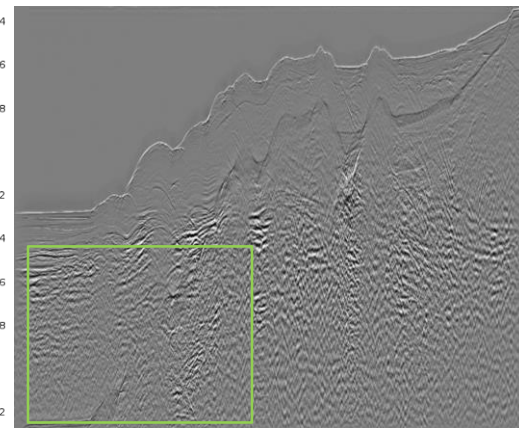
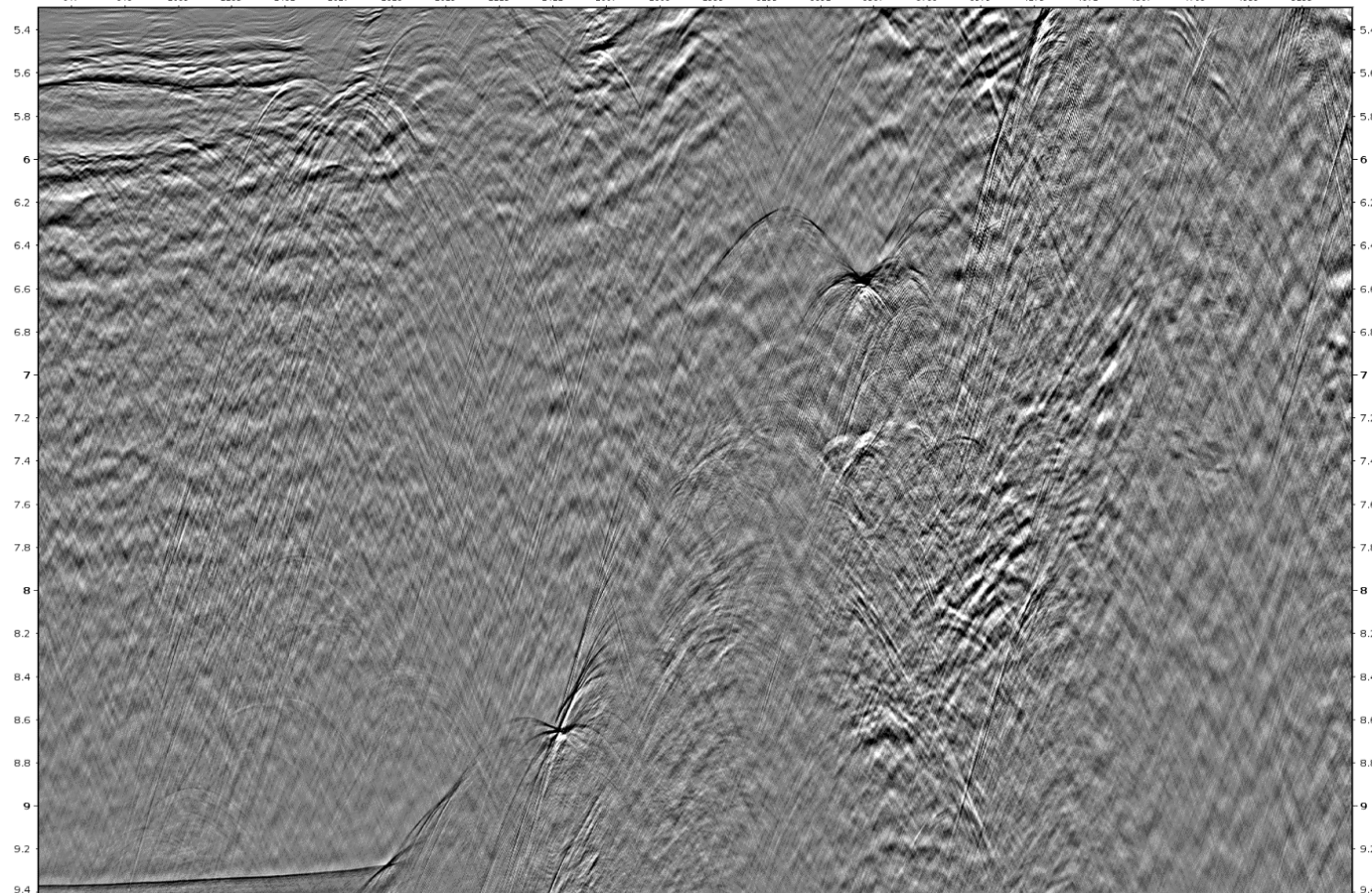


Zoom in Stack before Subtraction

64

LINESEQ 18 / CROSSLINE

647 843 1039 1235 1431 1627 1823 2019 2215 2411 2607 2803 2999 3195 3391 3587 3783 3979 4175 4371 4567 4763 4959 5155

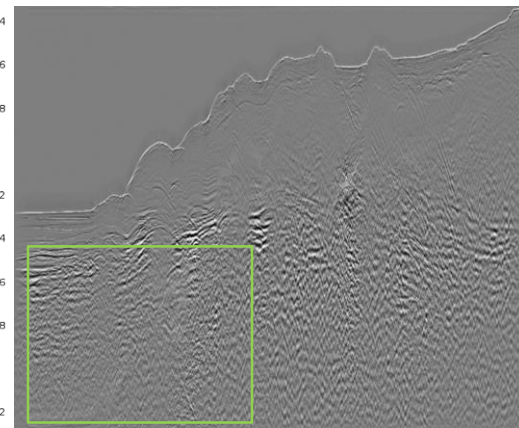
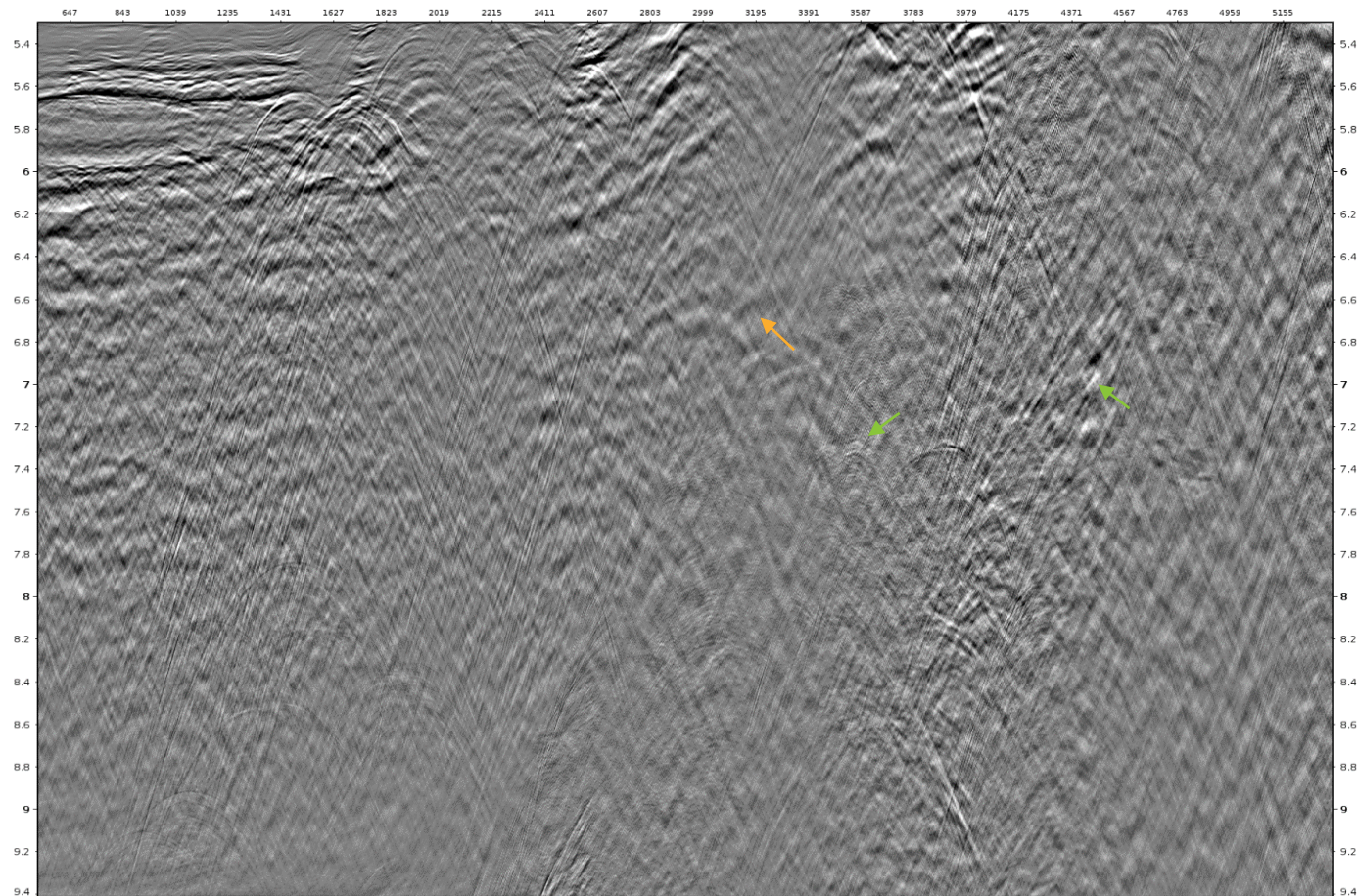


- Multiples are better attenuated with simultaneous subtraction.
- Primaries are protected by simultaneous subtraction flow.

Zoom in Stack after SRME Subtraction

65

LINESEQ 18 / CROSSLINE



- Multiples are better attenuated with simultaneous subtraction.
- Primaries are protected by simultaneous subtraction flow.

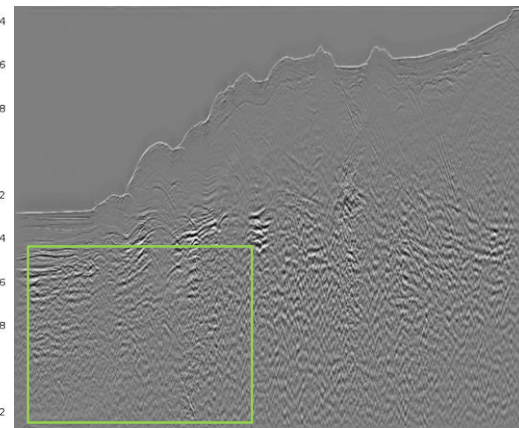
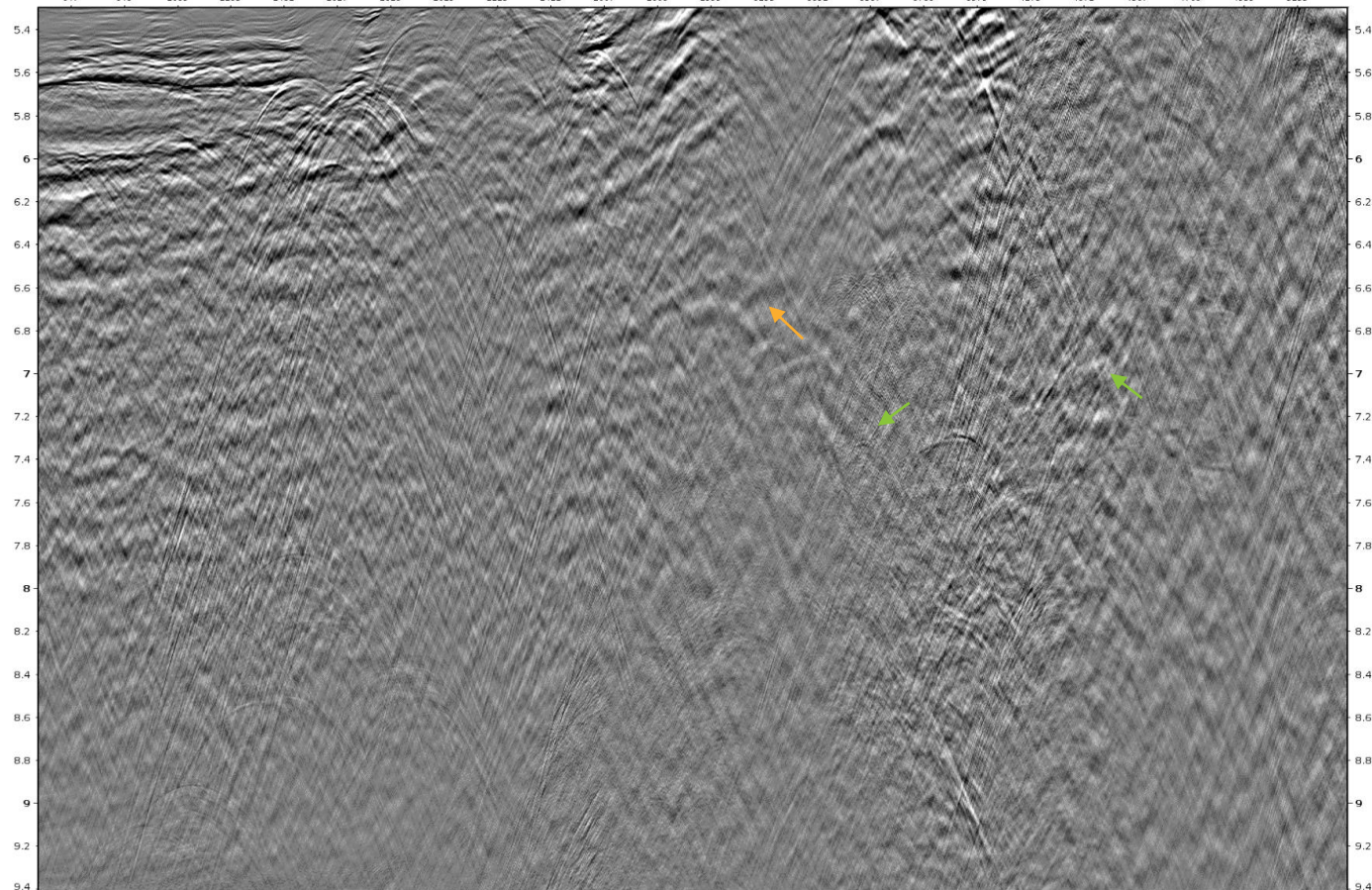


Zoom in Stack after SRME & MWD Subtraction

66

LINESEQ 18 / CROSSLINE

647 843 1039 1235 1431 1627 1823 2019 2215 2411 2607 2803 2999 3195 3391 3587 3783 3979 4175 4371 4567 4763 4959 5155

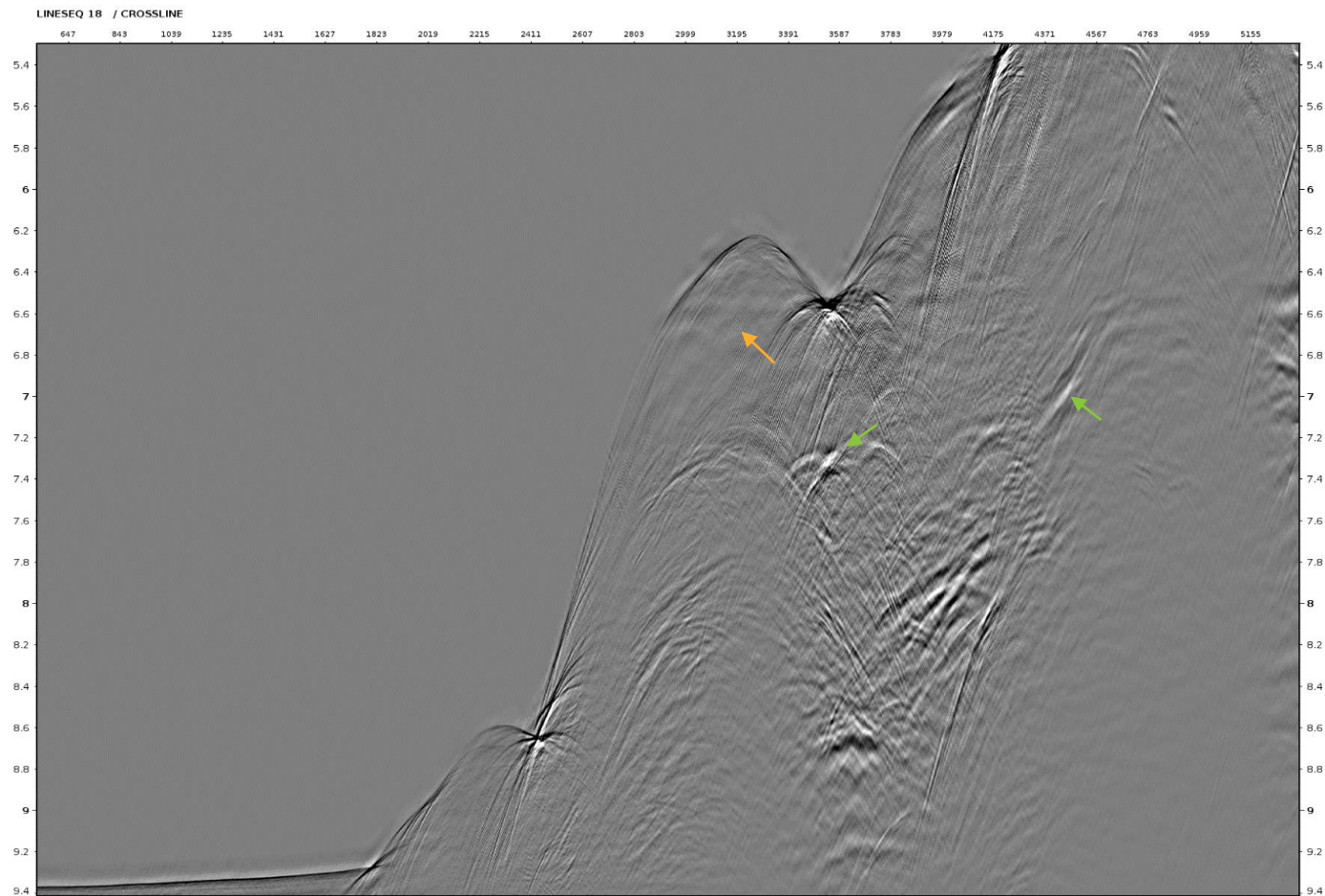


- Multiples are better attenuated with simultaneous subtraction.
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Difference before – after SRME Subtraction

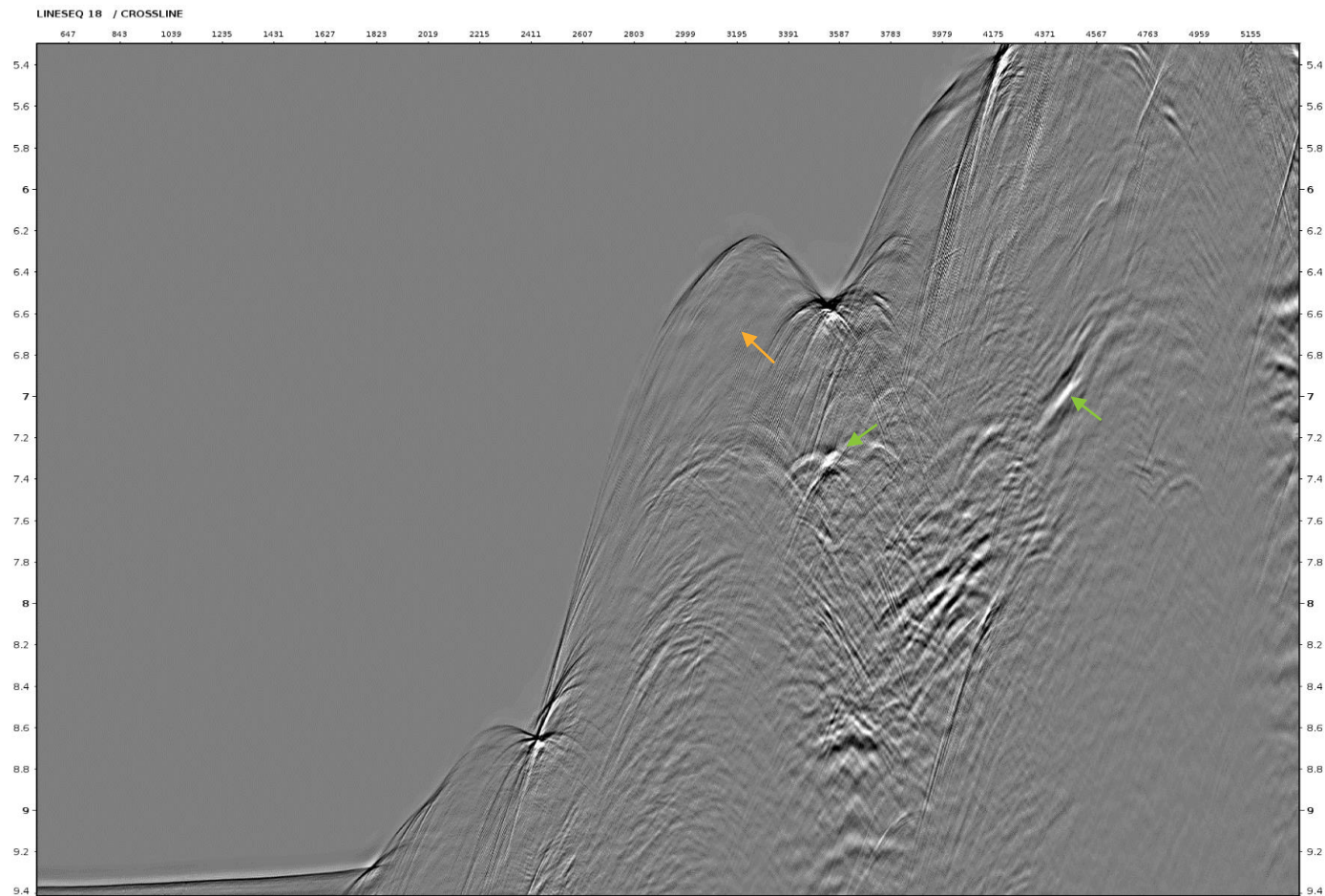
67

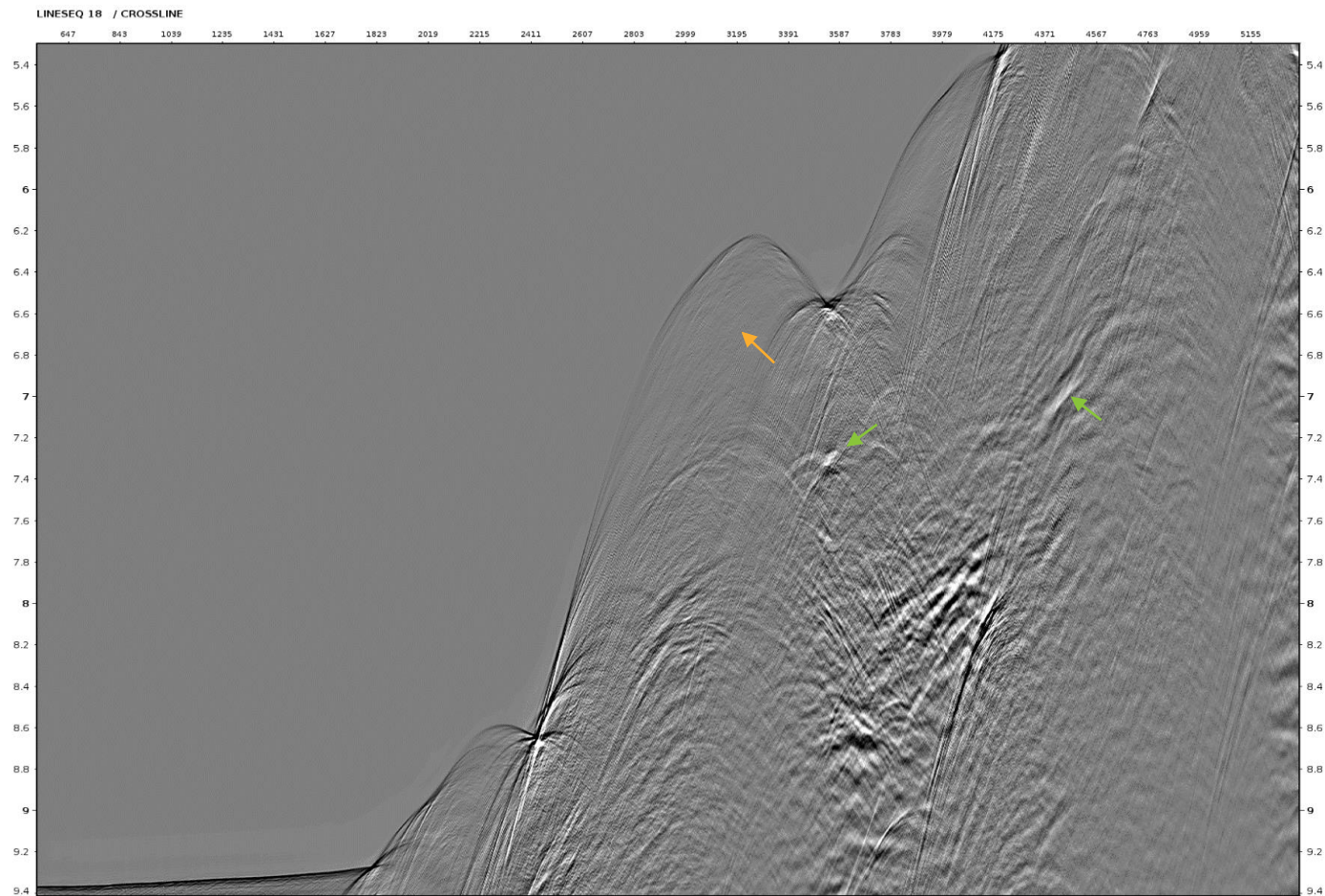




Difference before – after SRME & MWD Subtraction

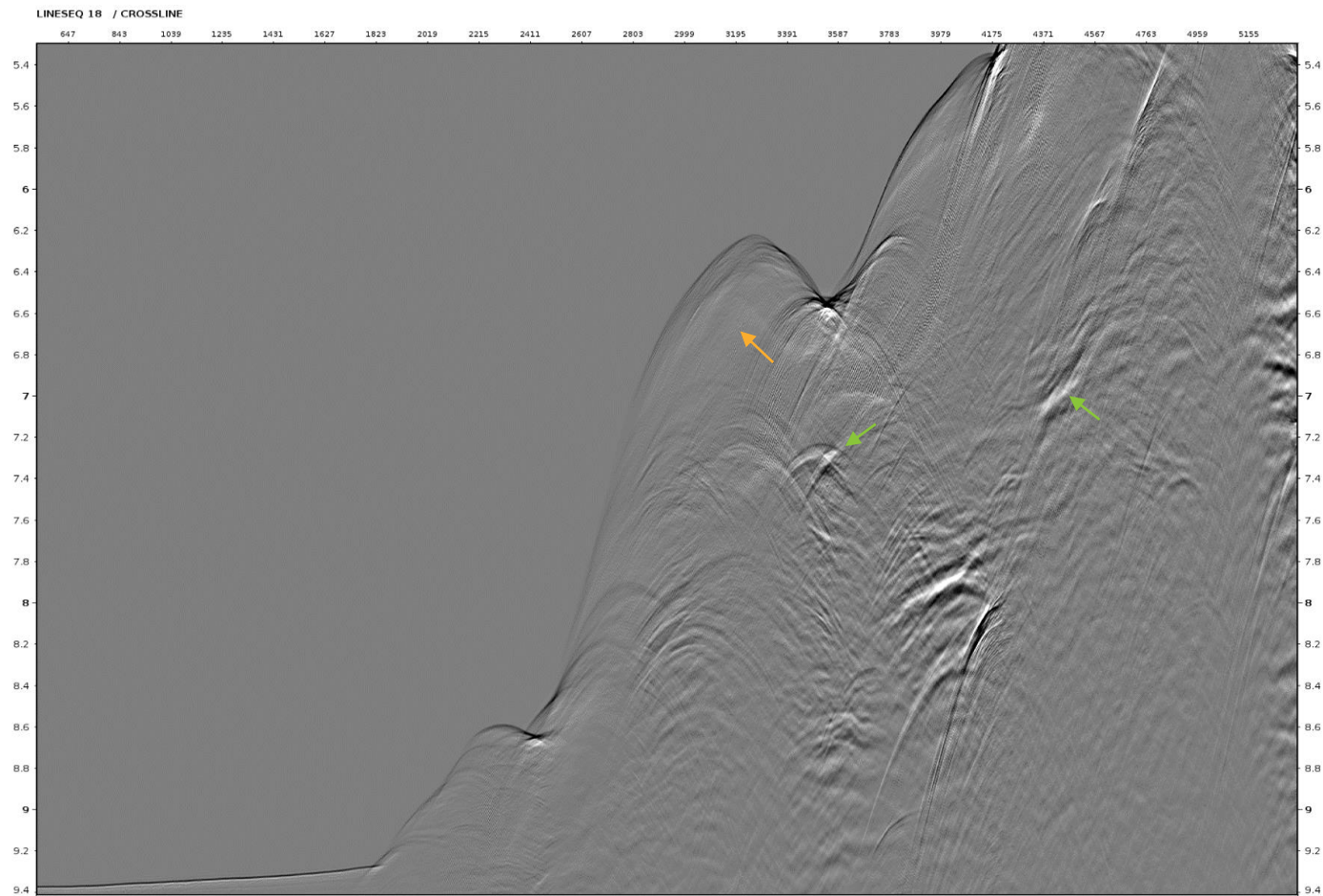
68





Zoom in Stack – MWD Model

70



Seq 018

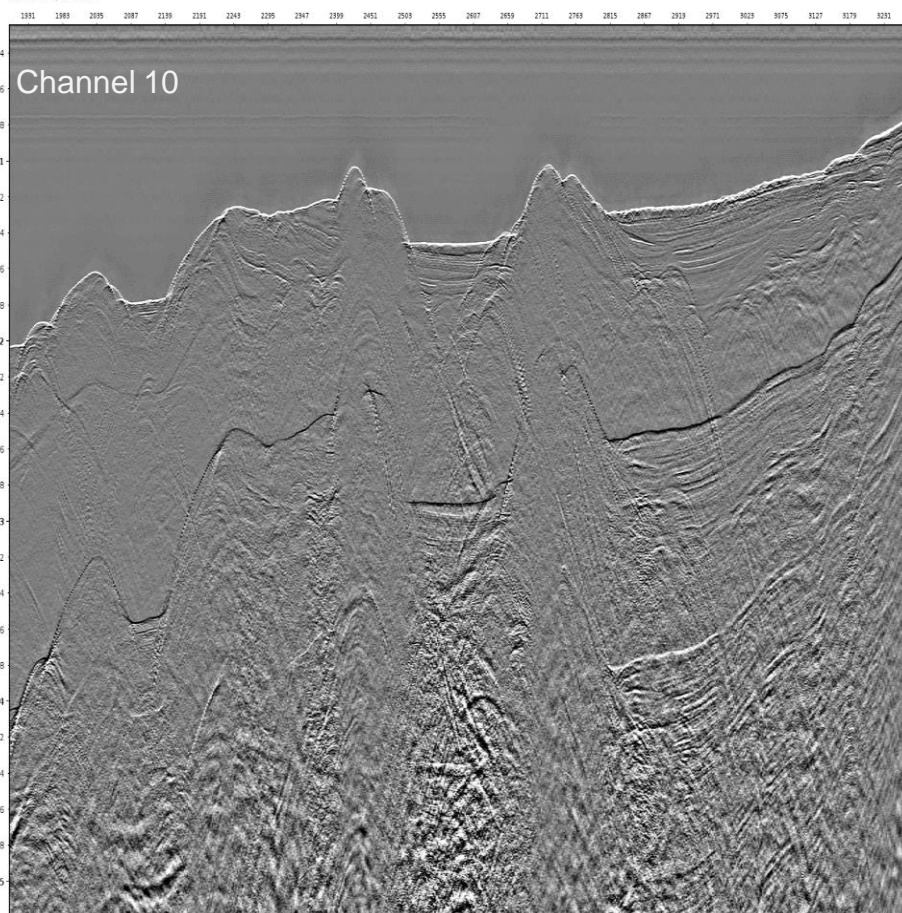
Stack

Common Channel

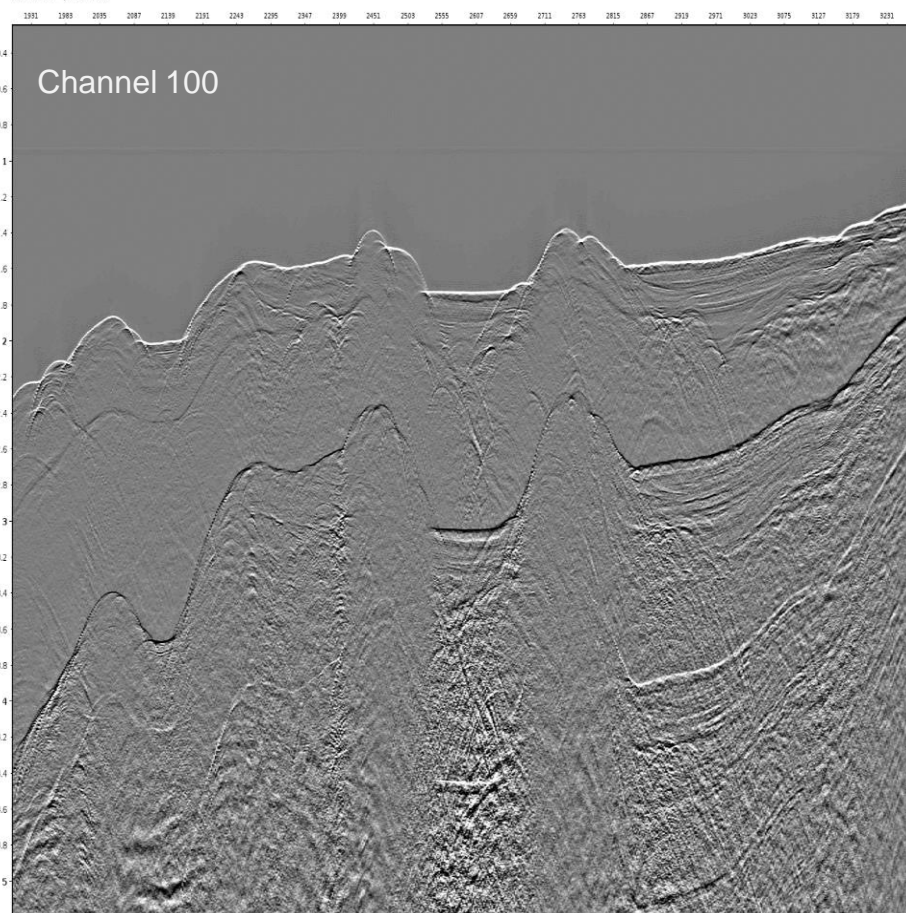
Shot Gathers



CABTR 10 / NAVSHOT



CABTR 100 / NAVSHOT

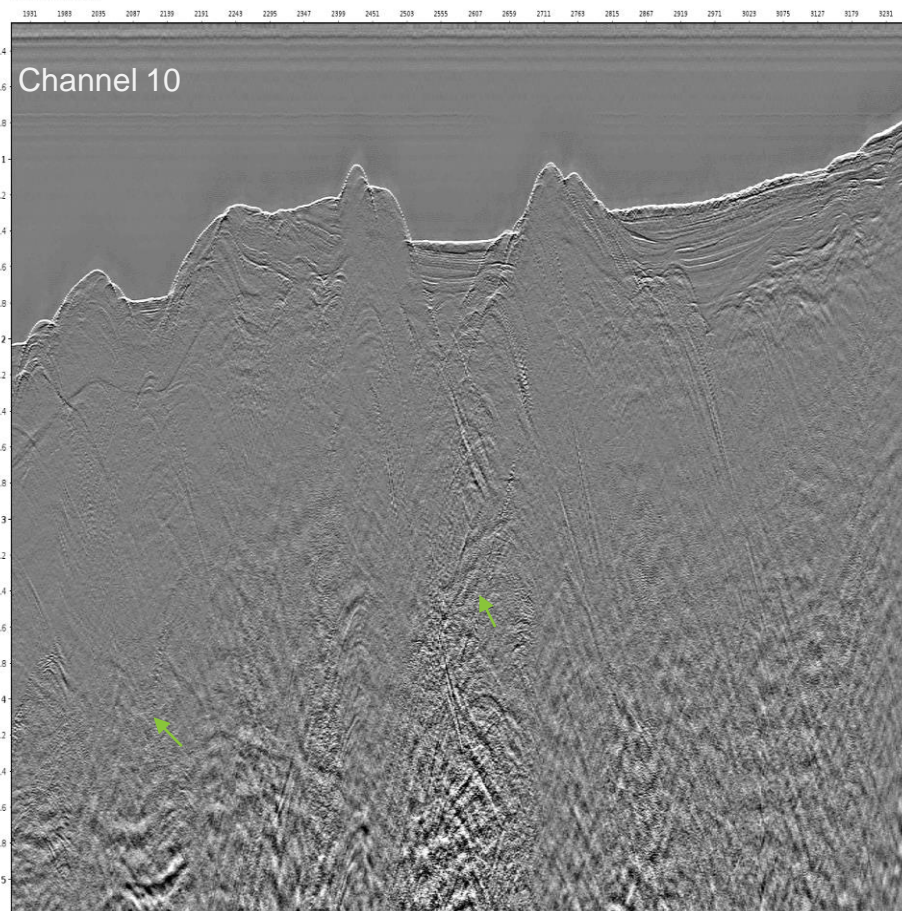




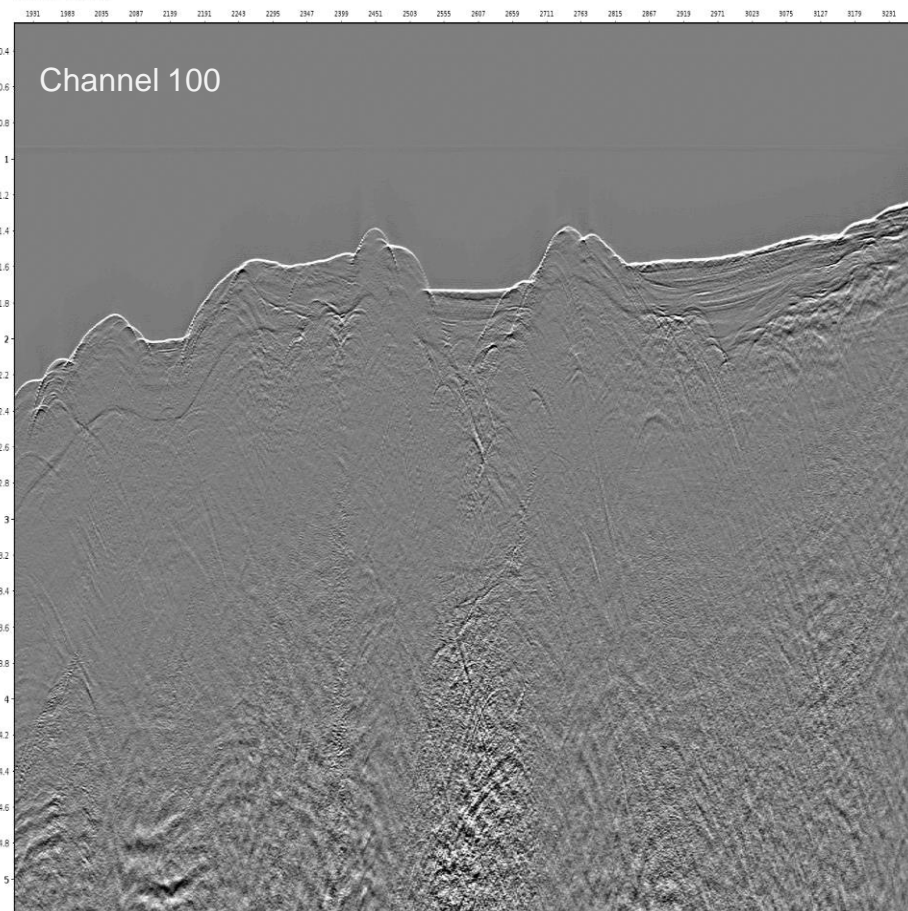
Common Channel **after** SRME Subtraction

73

CABTR 10 / NAVSHOT



CABTR 100 / NAVSHOT

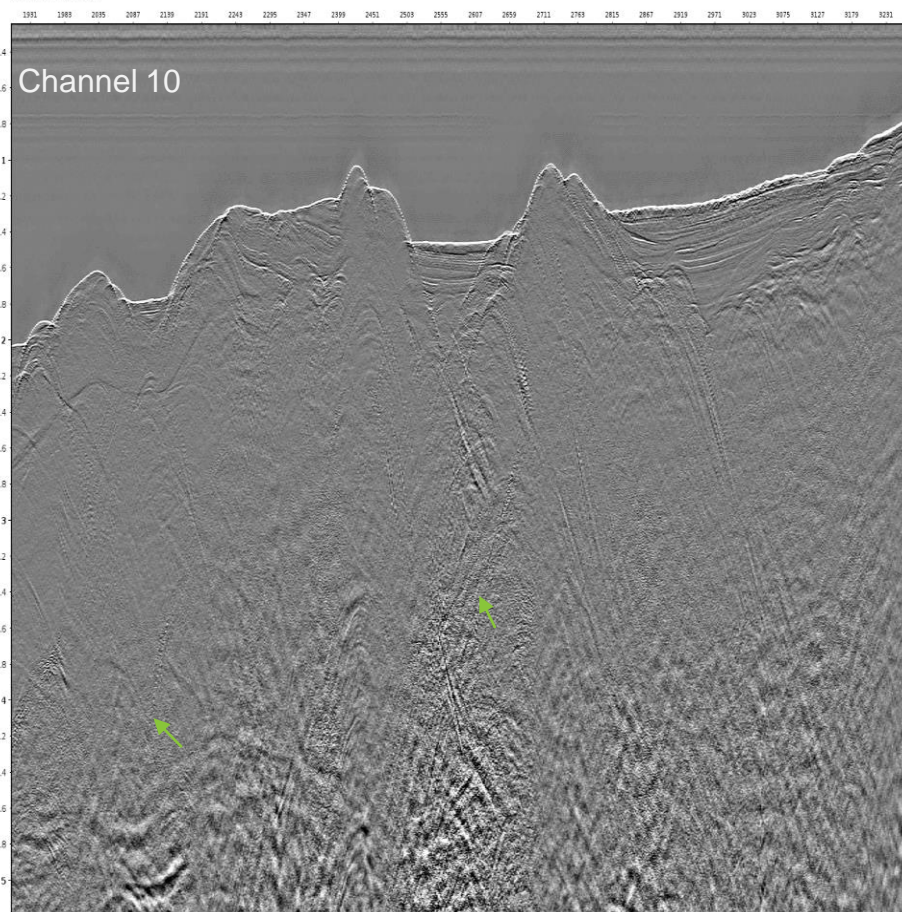




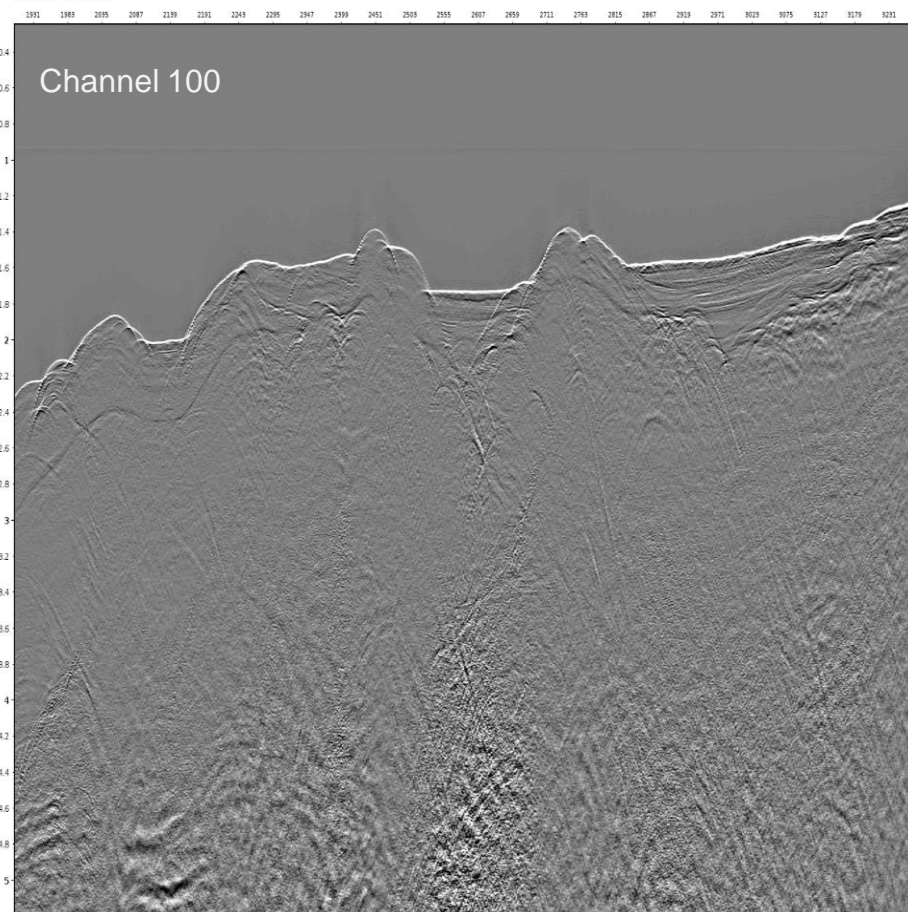
Common Channel **after** SRME & MWD Subtraction

74

CABTR 10 / NAVSHOT



CABTR 100 / NAVSHOT

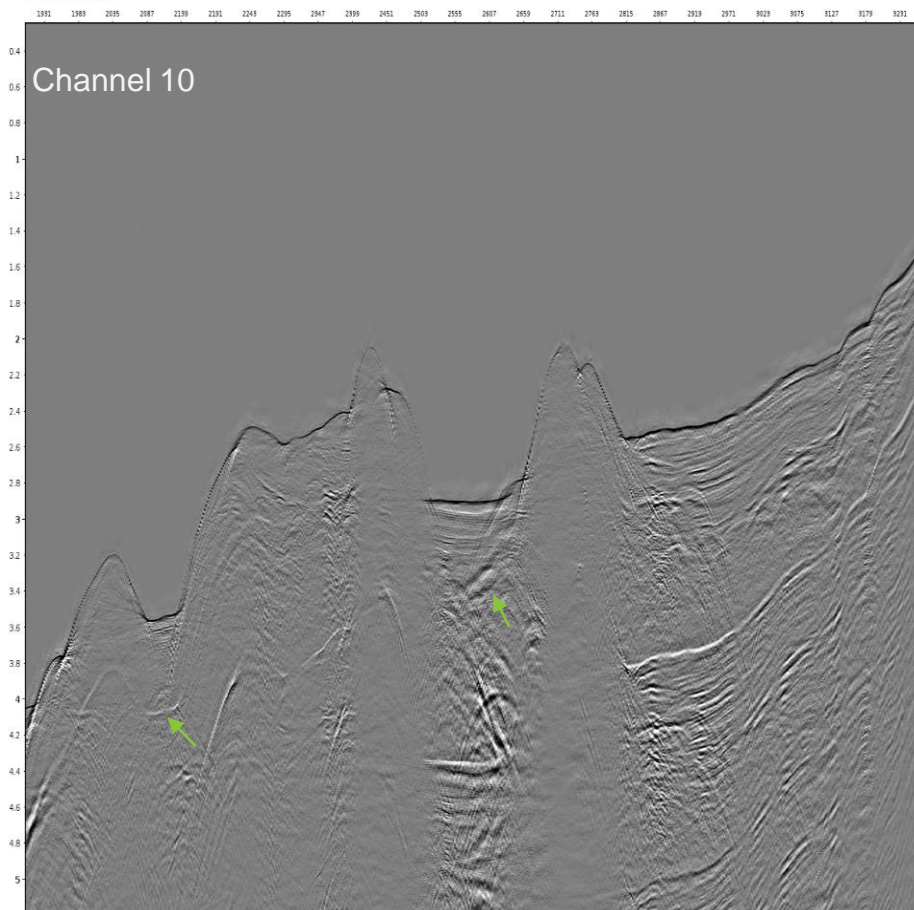




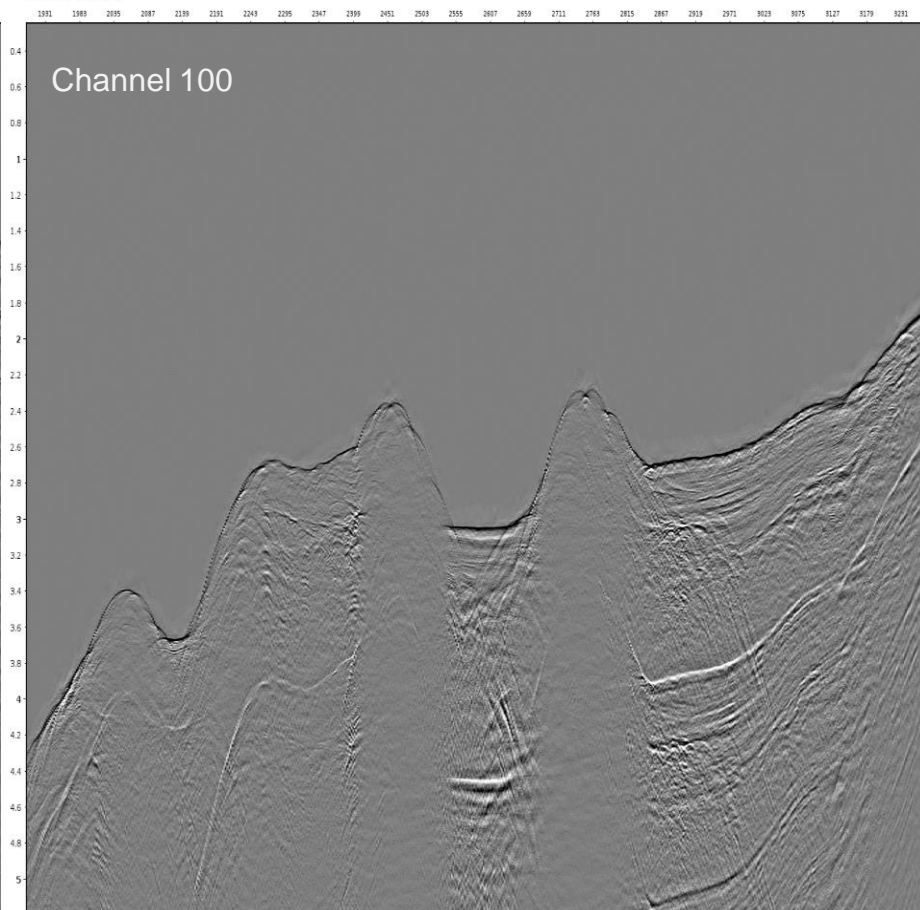
Difference before – after SRME Subtraction

75

CABR 10 / NAVSHOT



CABR 100 / NAVSHOT

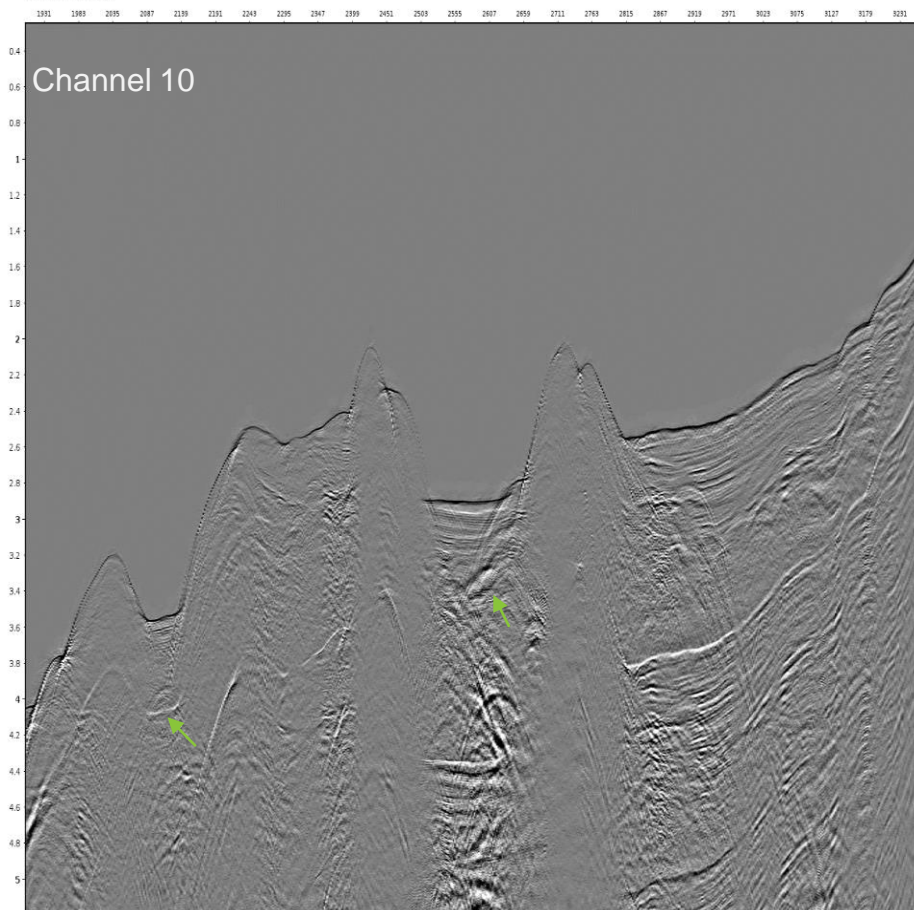




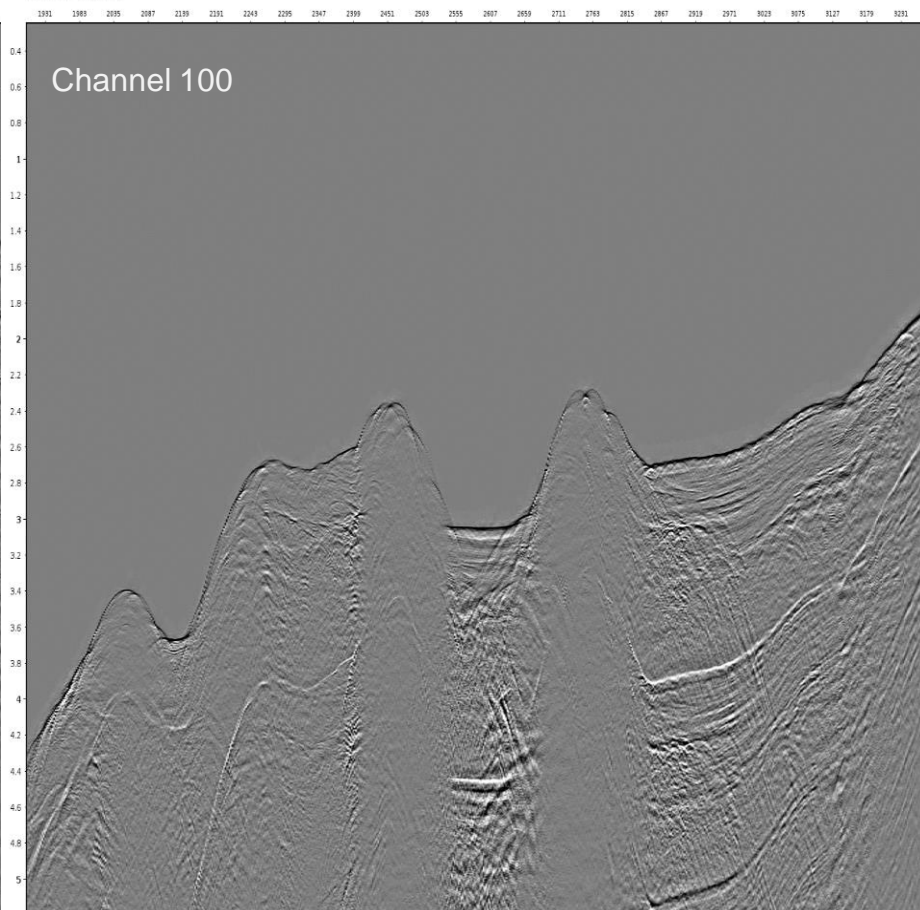
Difference before – after SRME & MWD Subtraction

76

CABTR 10 / NAVSHOT

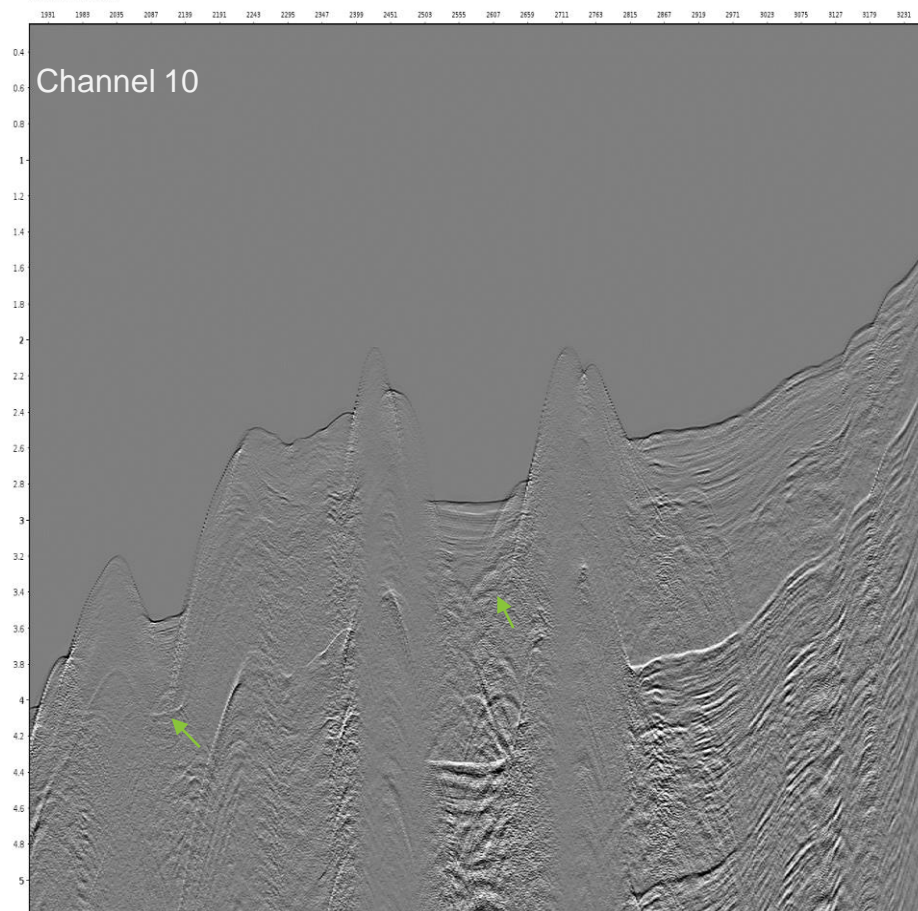


CABTR 100 / NAVSHOT

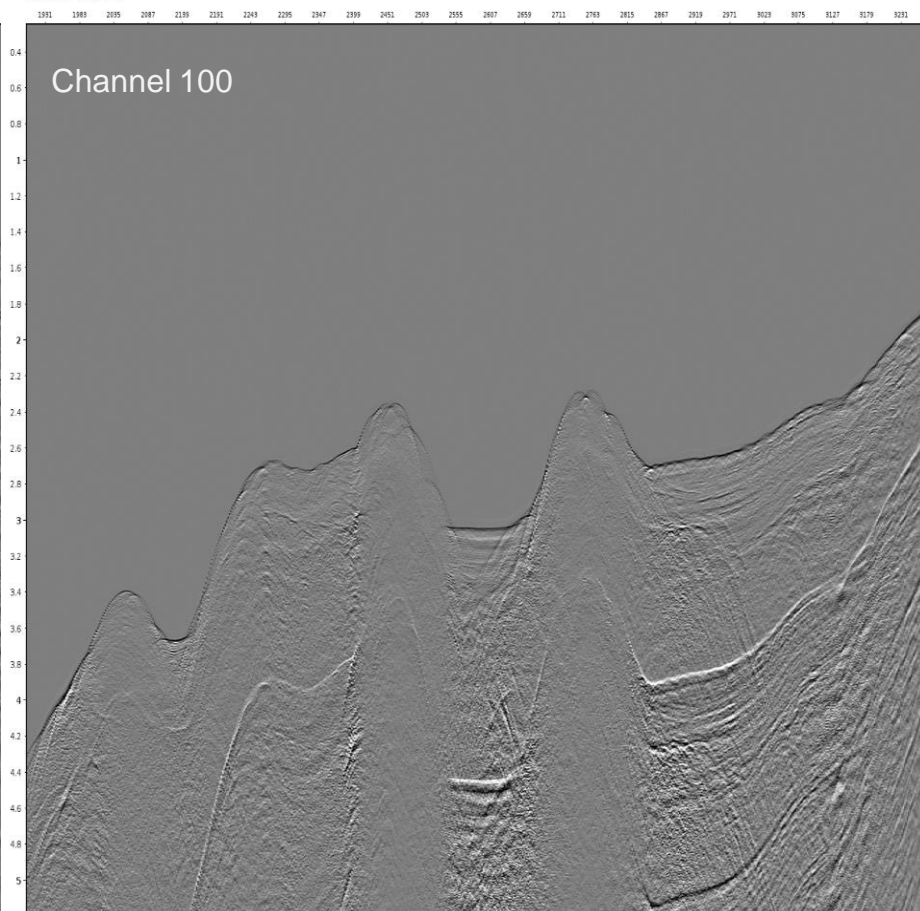




CABTR 10 / NAVSHOT

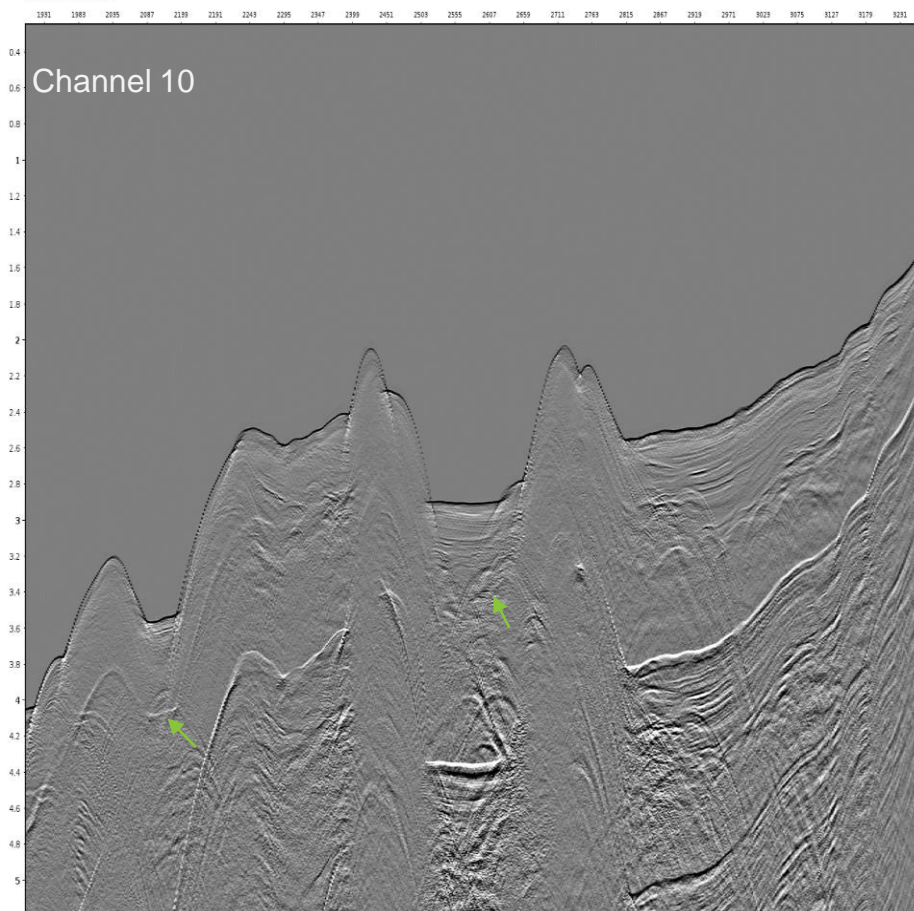


CABTR 100 / NAVSHOT

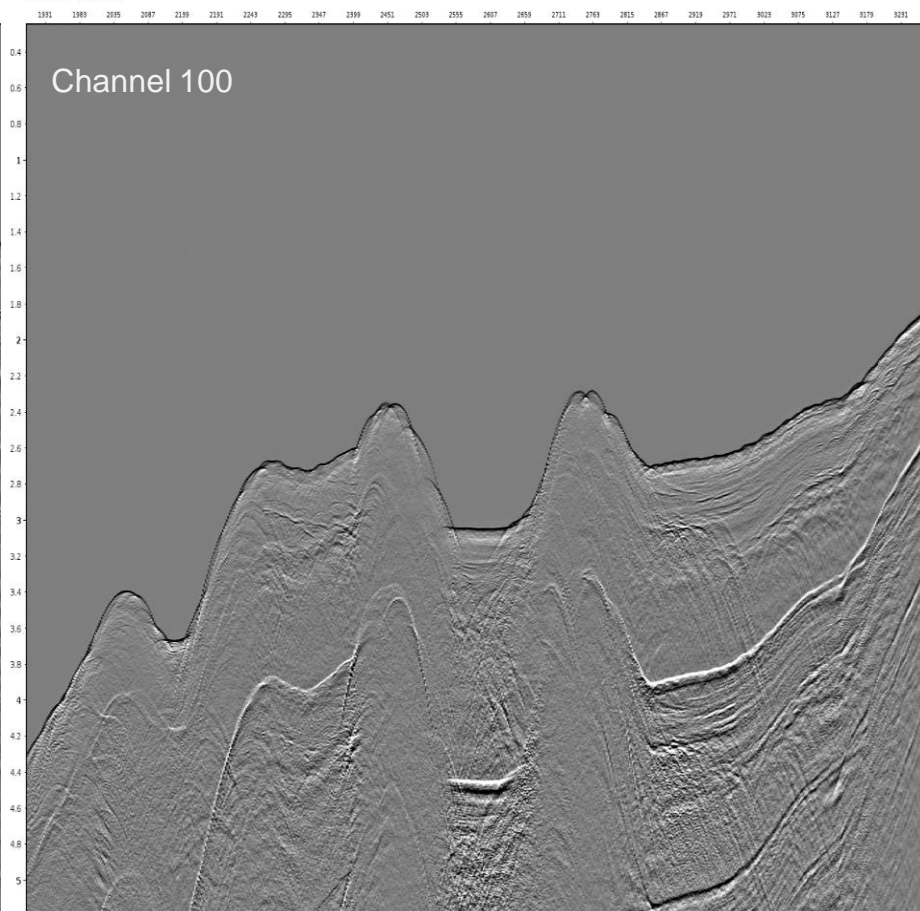


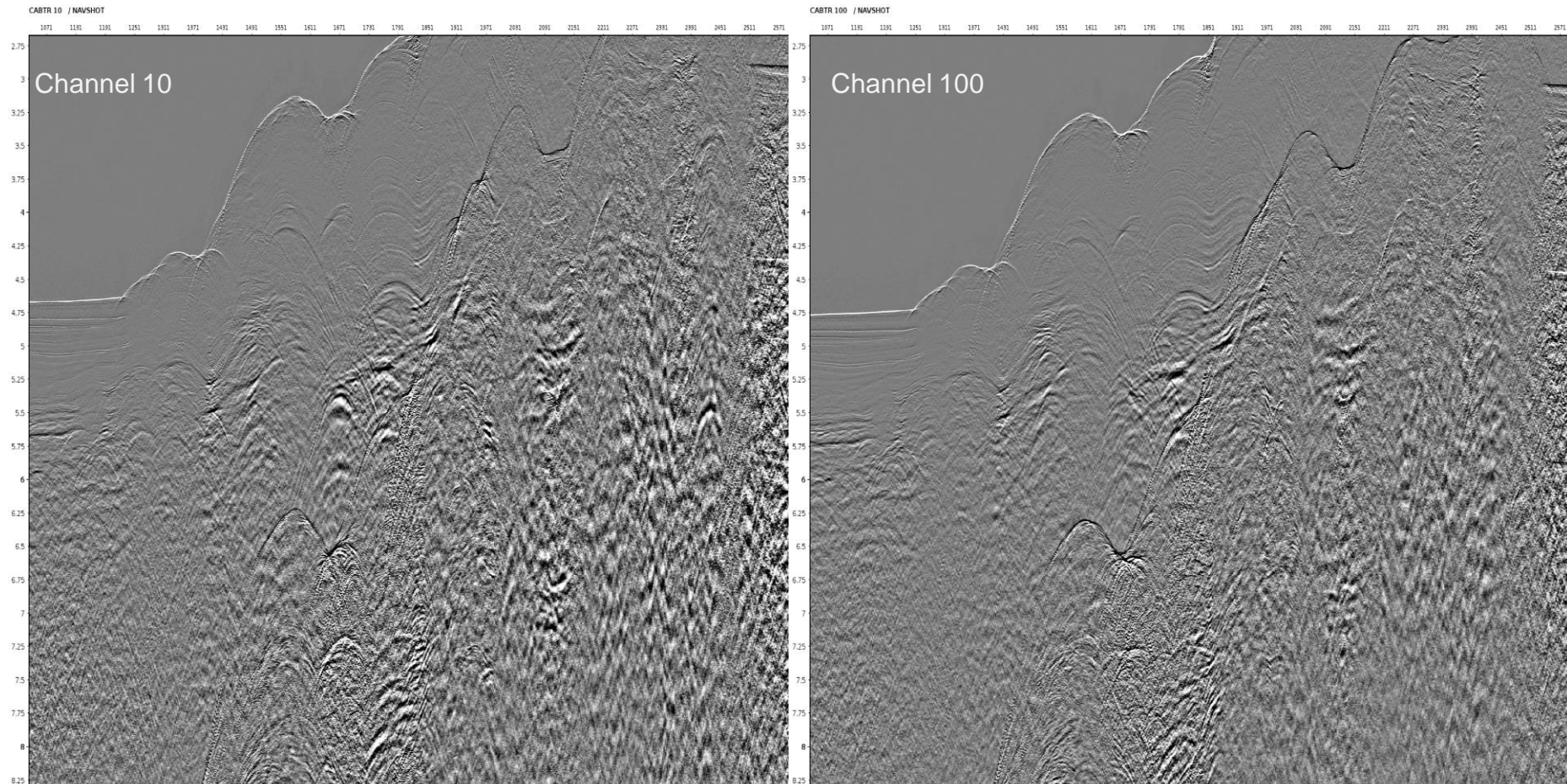


CABTR 10 / NAVSHOT



CABTR 100 / NAVSHOT



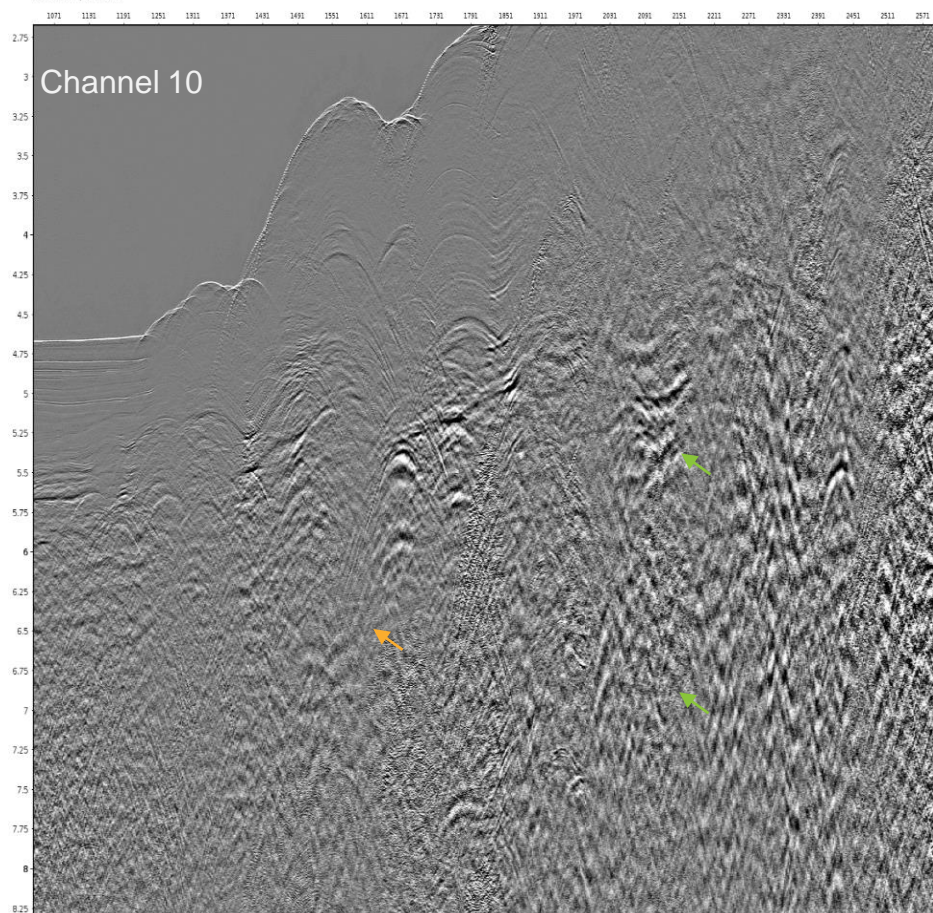




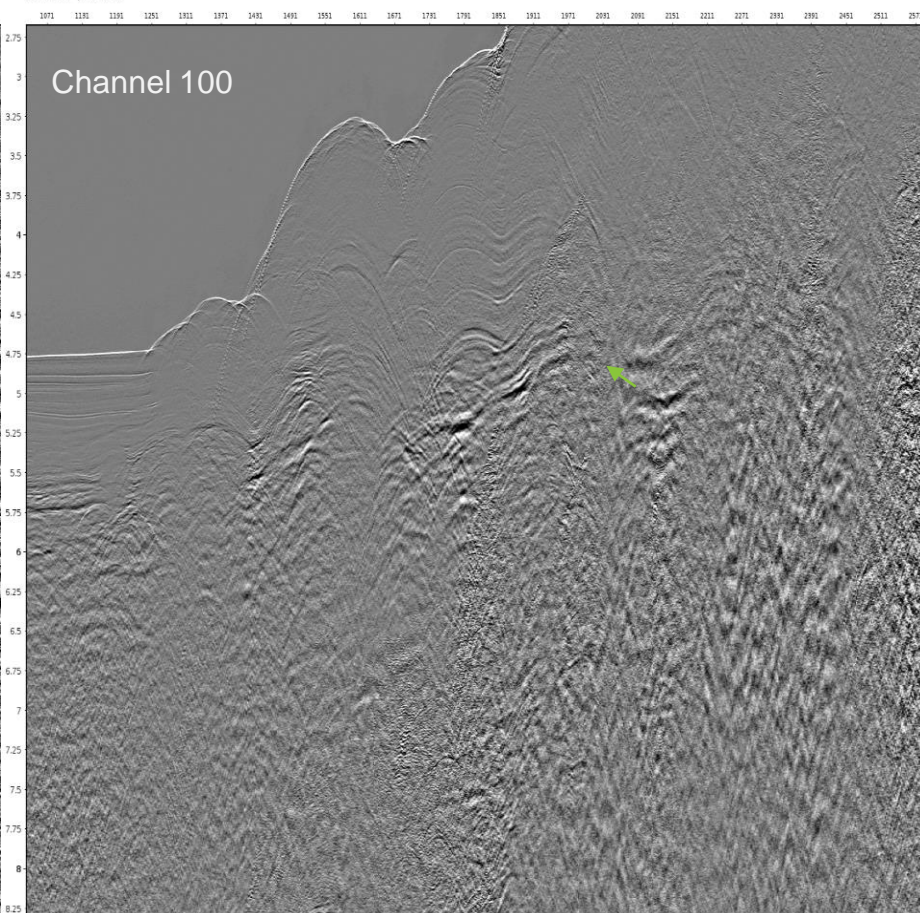
Common Channel **after** SRME Subtraction

80

CABTR 10 / NAVSHOT

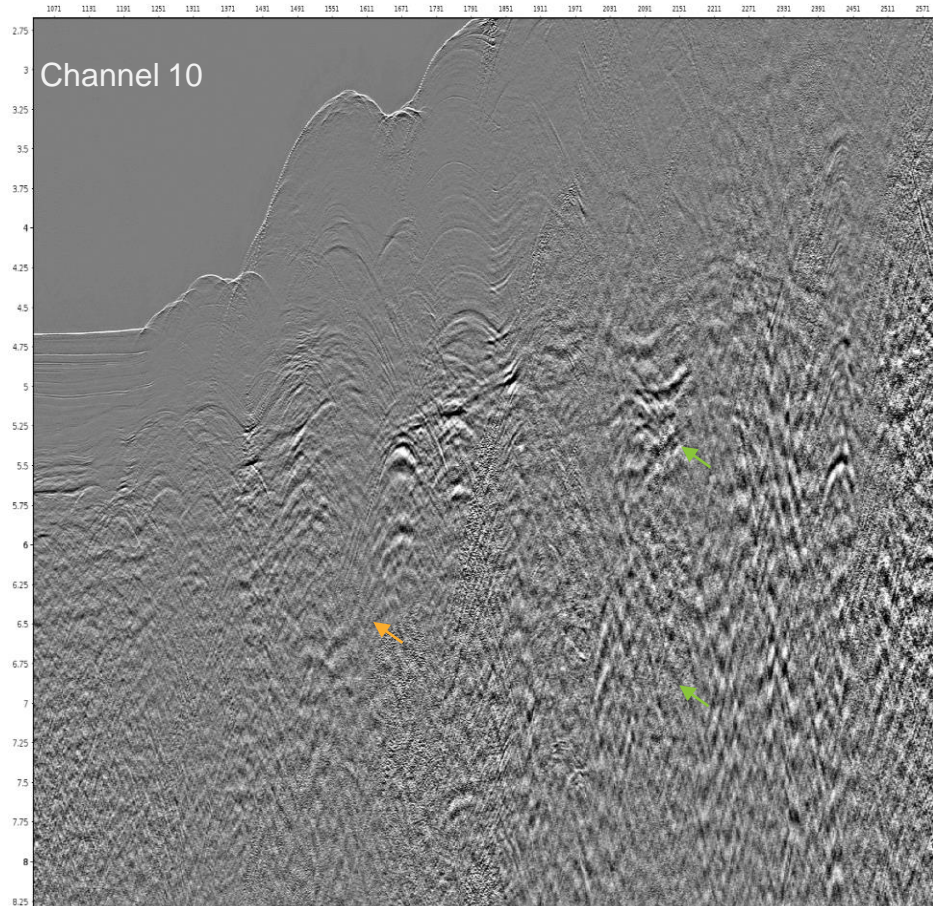


CABTR 100 / NAVSHOT

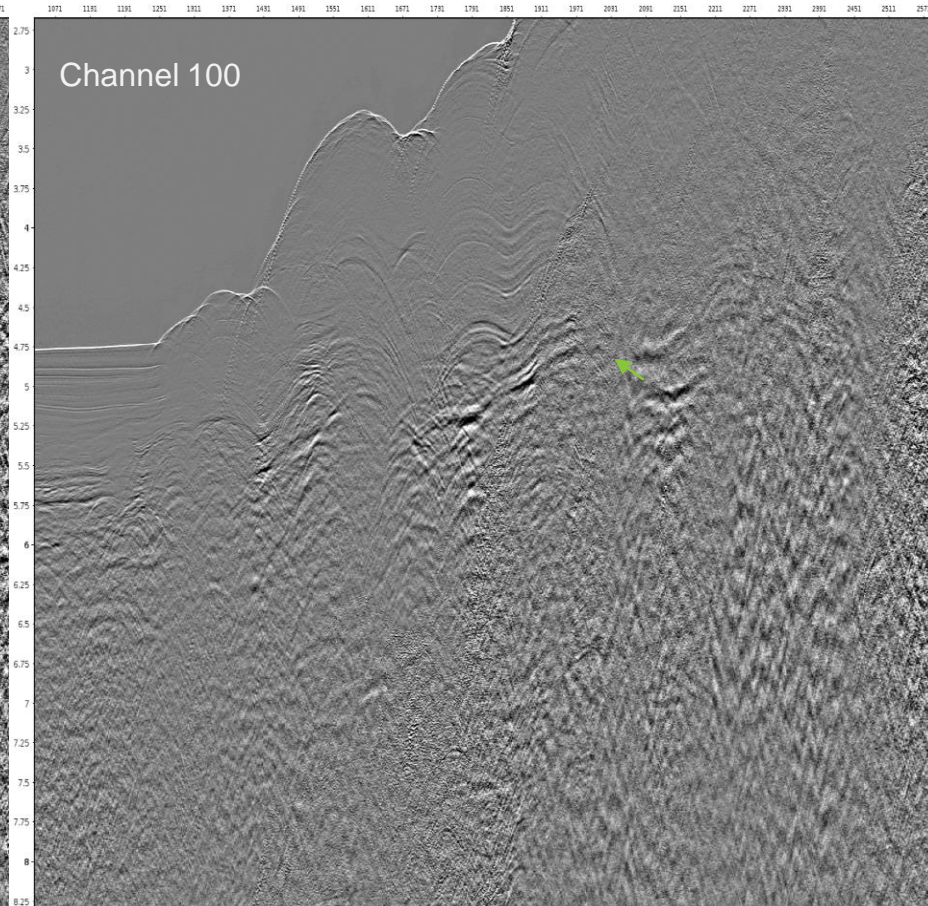




CABR 10 / NAVSHOT



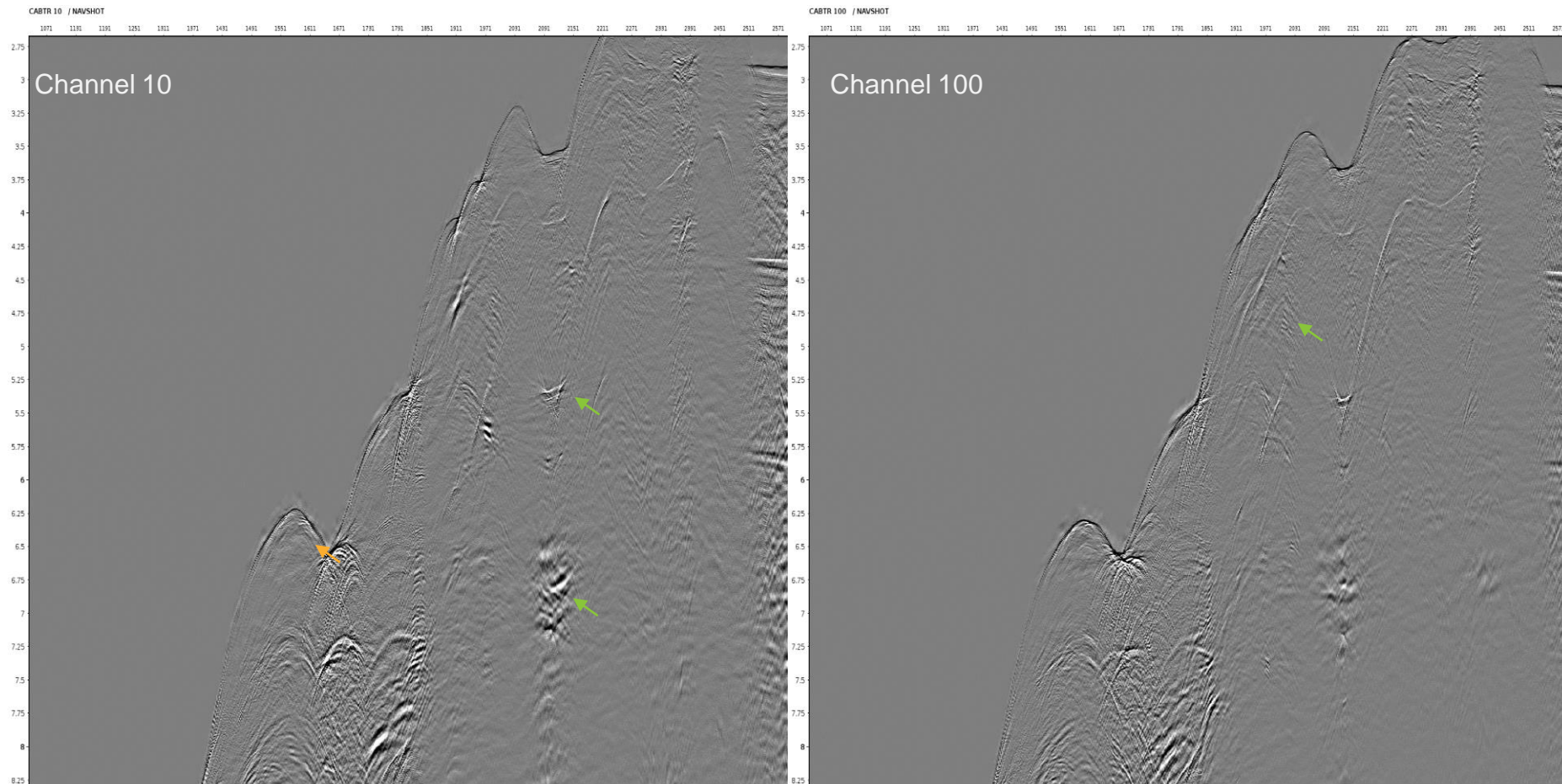
CABR 100 / NAVSHOT





Difference before – after SRME Subtraction

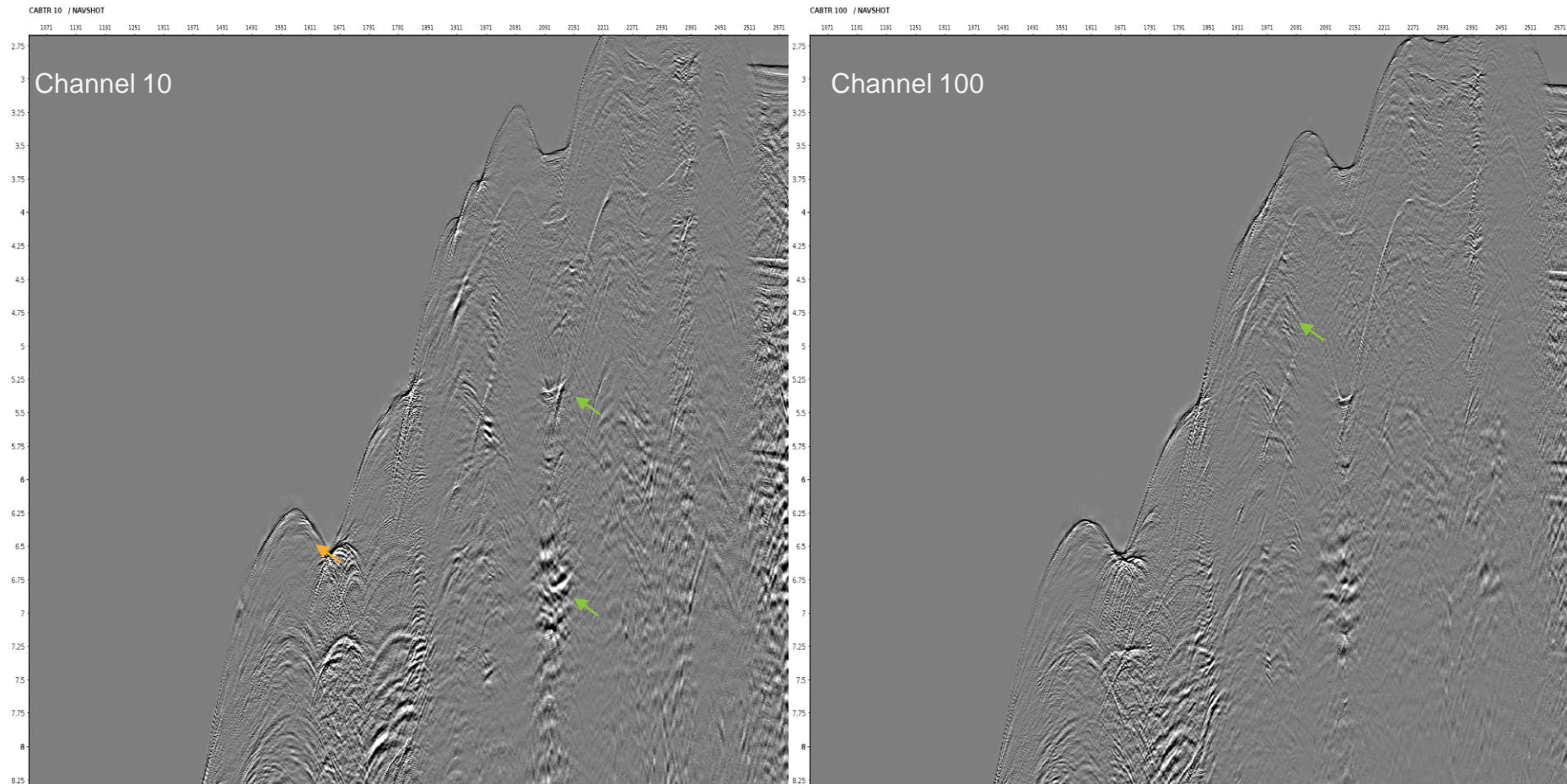
82





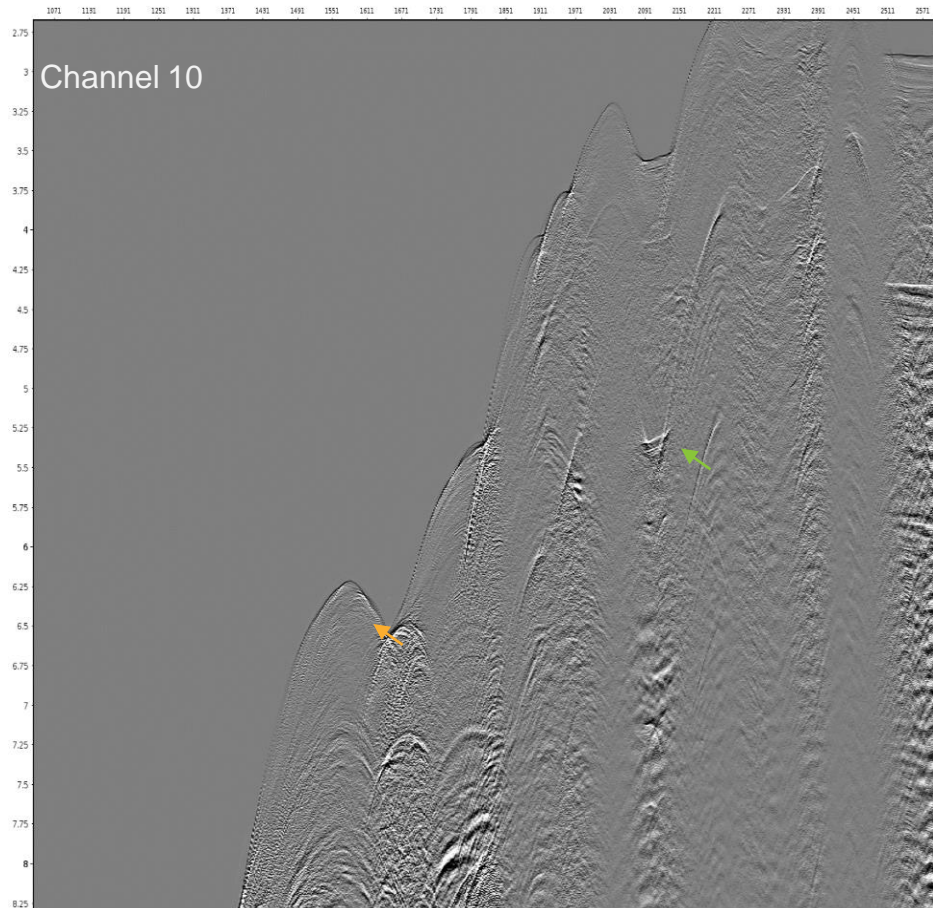
Difference before – after SRME & MWD Subtraction

83

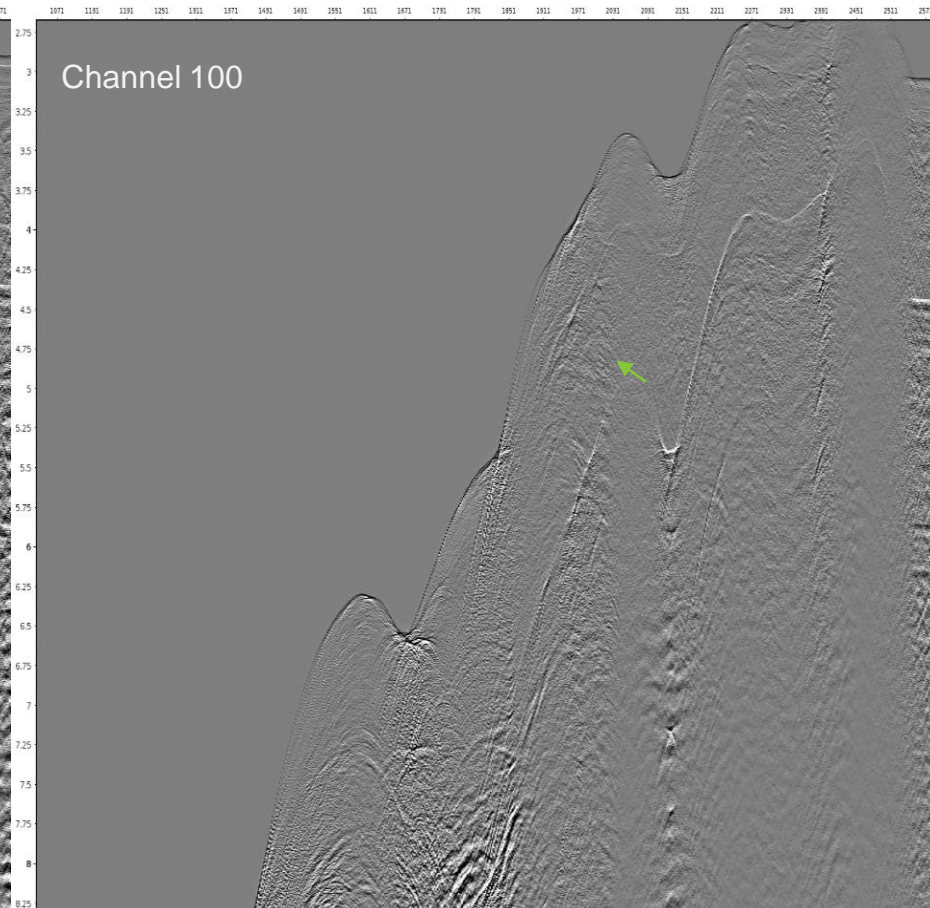


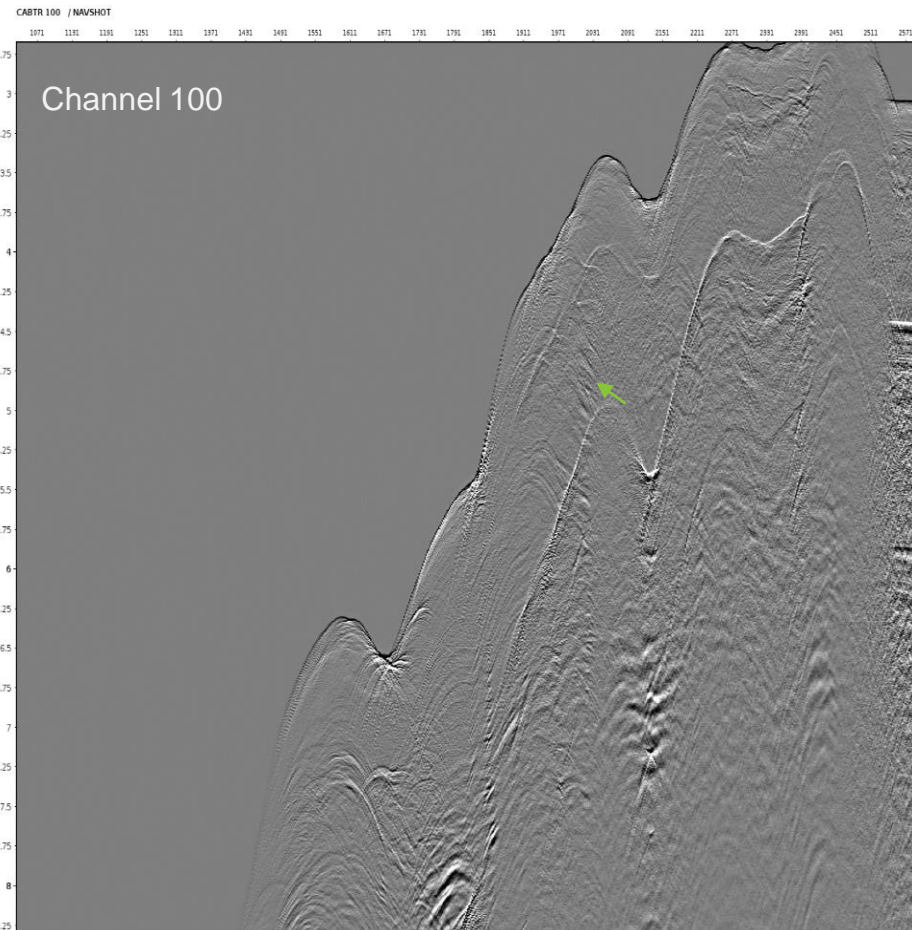
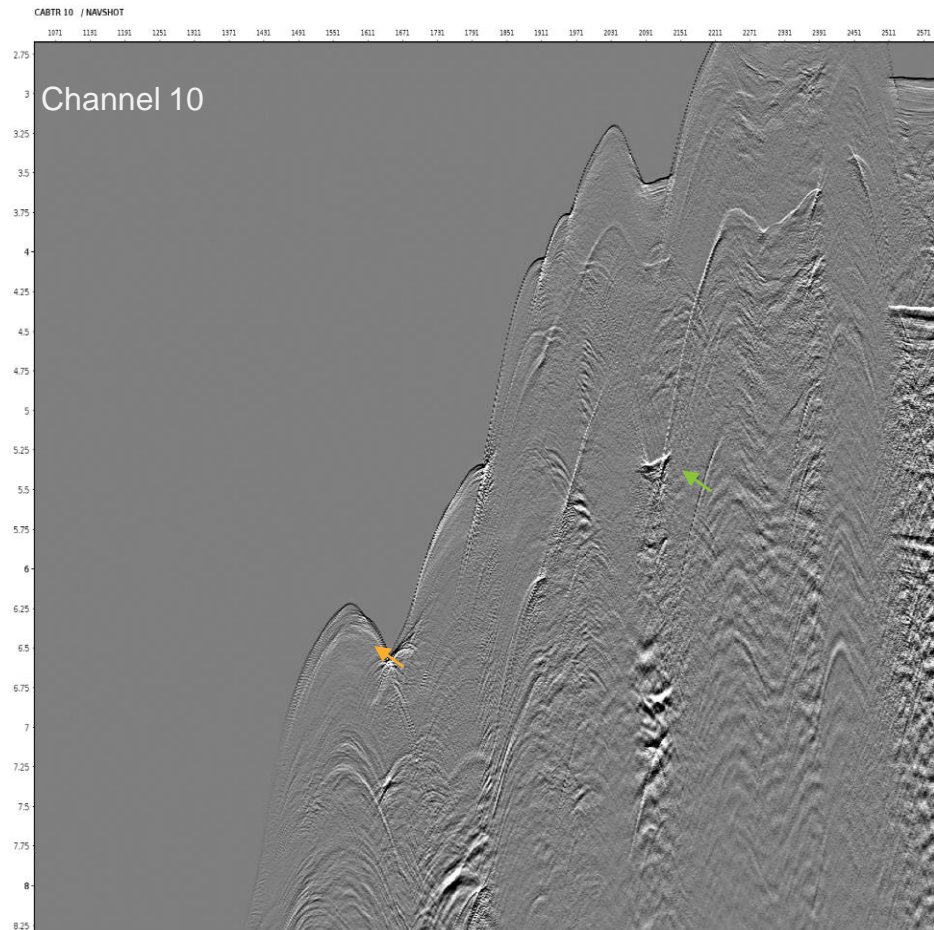


CABTR 10 / NAVSHOT



CABTR 100 / NAVSHOT





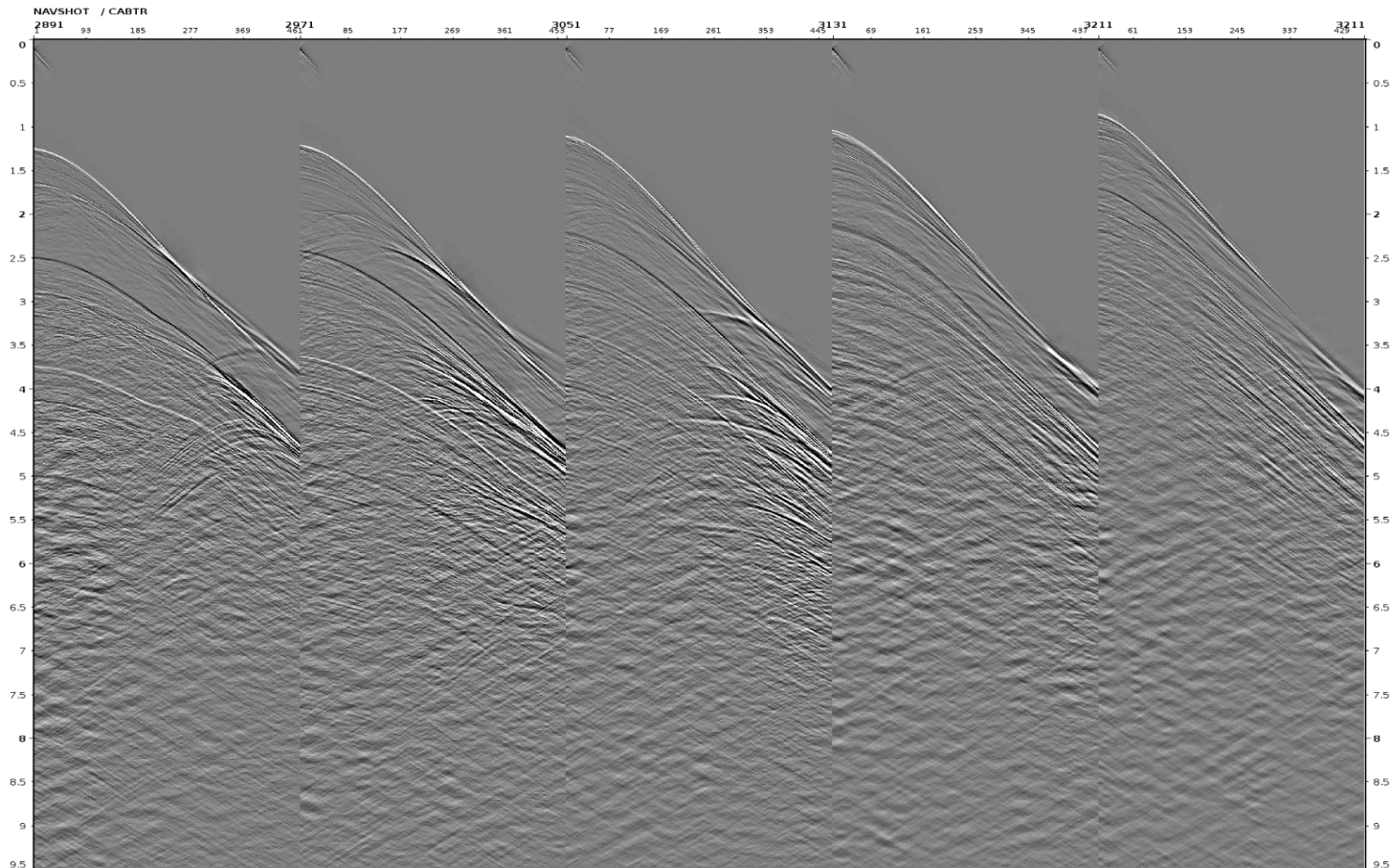
Seq 018

Stack

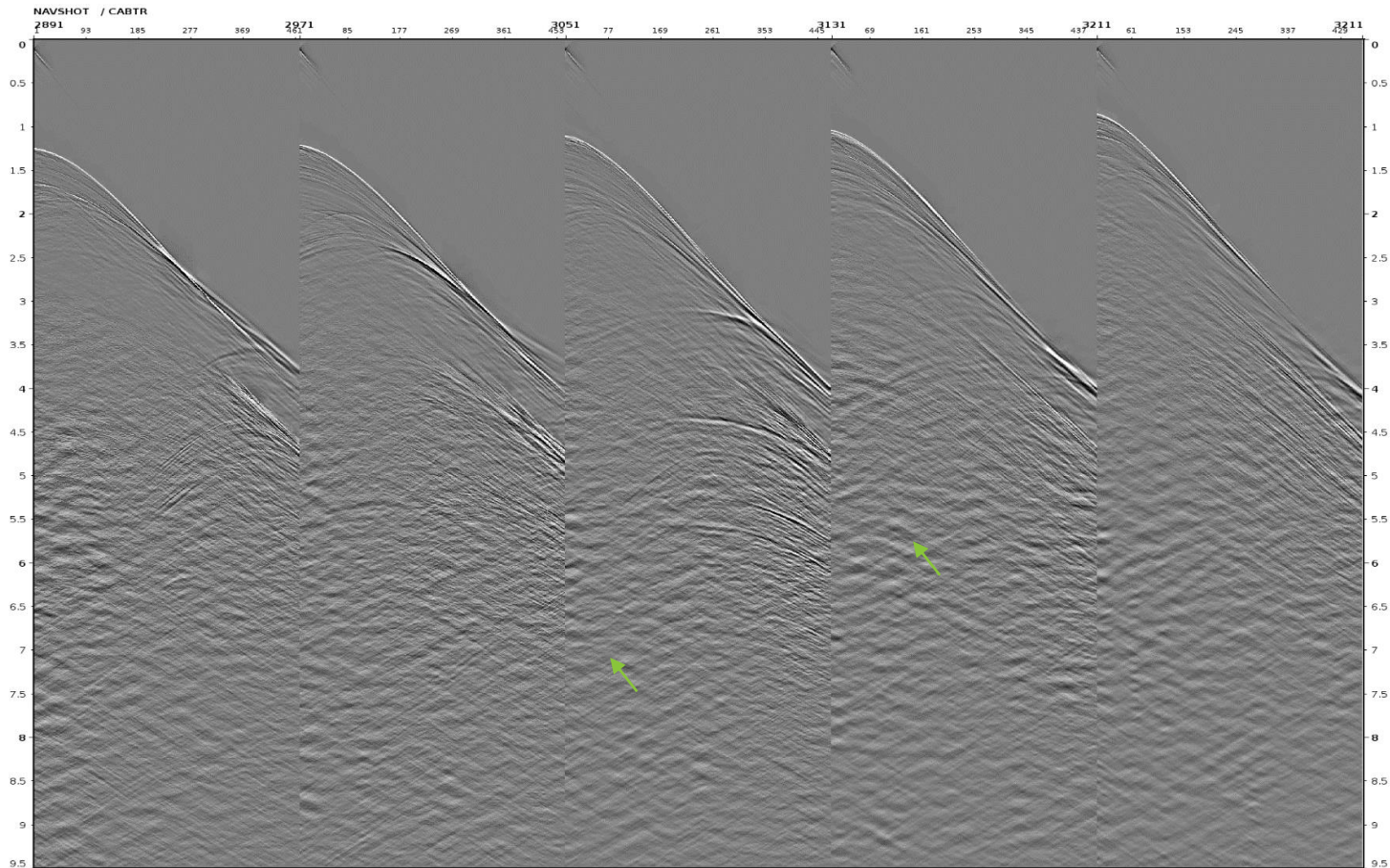
Common Channel

Shot Gathers





- Simultaneous subtraction flow with MWD & SRME shows benefits in surface related multiples removal and primaries protection.
- Far offset dipping residual will be further removed by “Radon” and residual LNA (Linear noise attenuation).

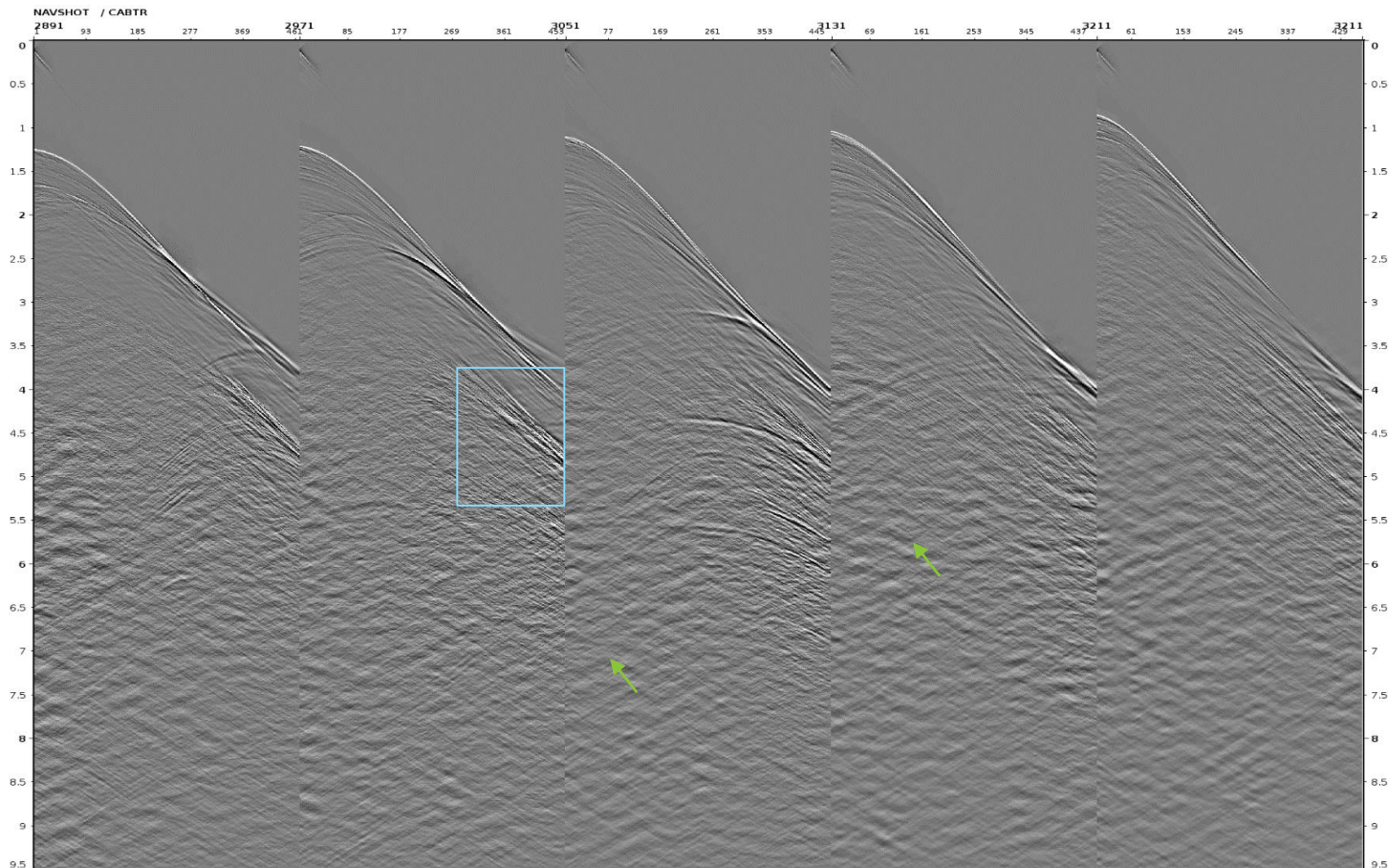


- Simultaneous subtraction flow with MWD & SRME shows benefits in surface related multiples removal and primaries protection.
- Far offset dipping residual will be further removed by “Radon” and residual LNA (Linear noise attenuation).



Selected Shots after SRME & MWD Subtraction

89

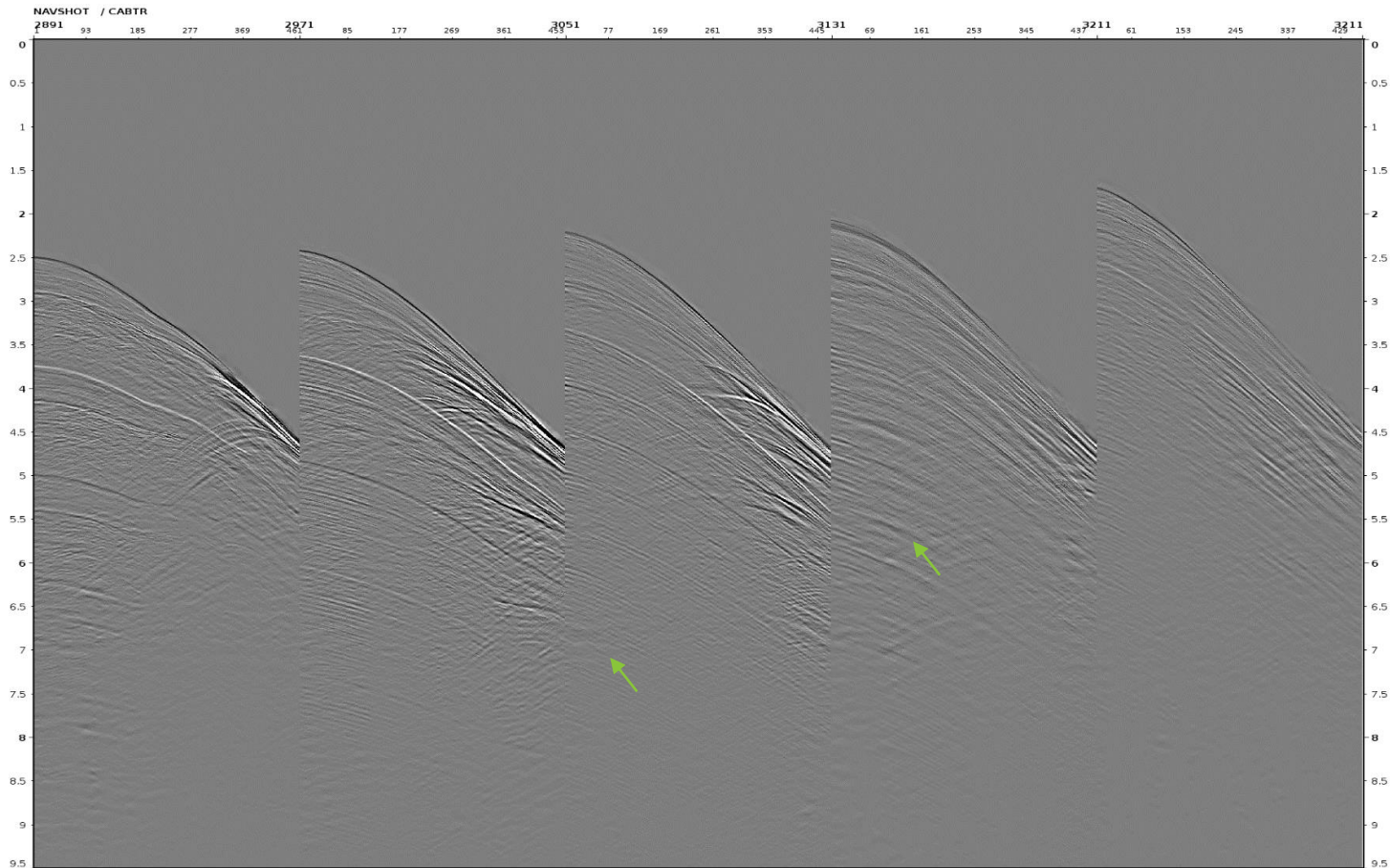


- Simultaneous subtraction flow with MWD & SRME shows benefits in surface related multiples removal and primaries protection.
- Far offset dipping residual will be further removed by “Radon” and residual LNA (Linear noise attenuation).

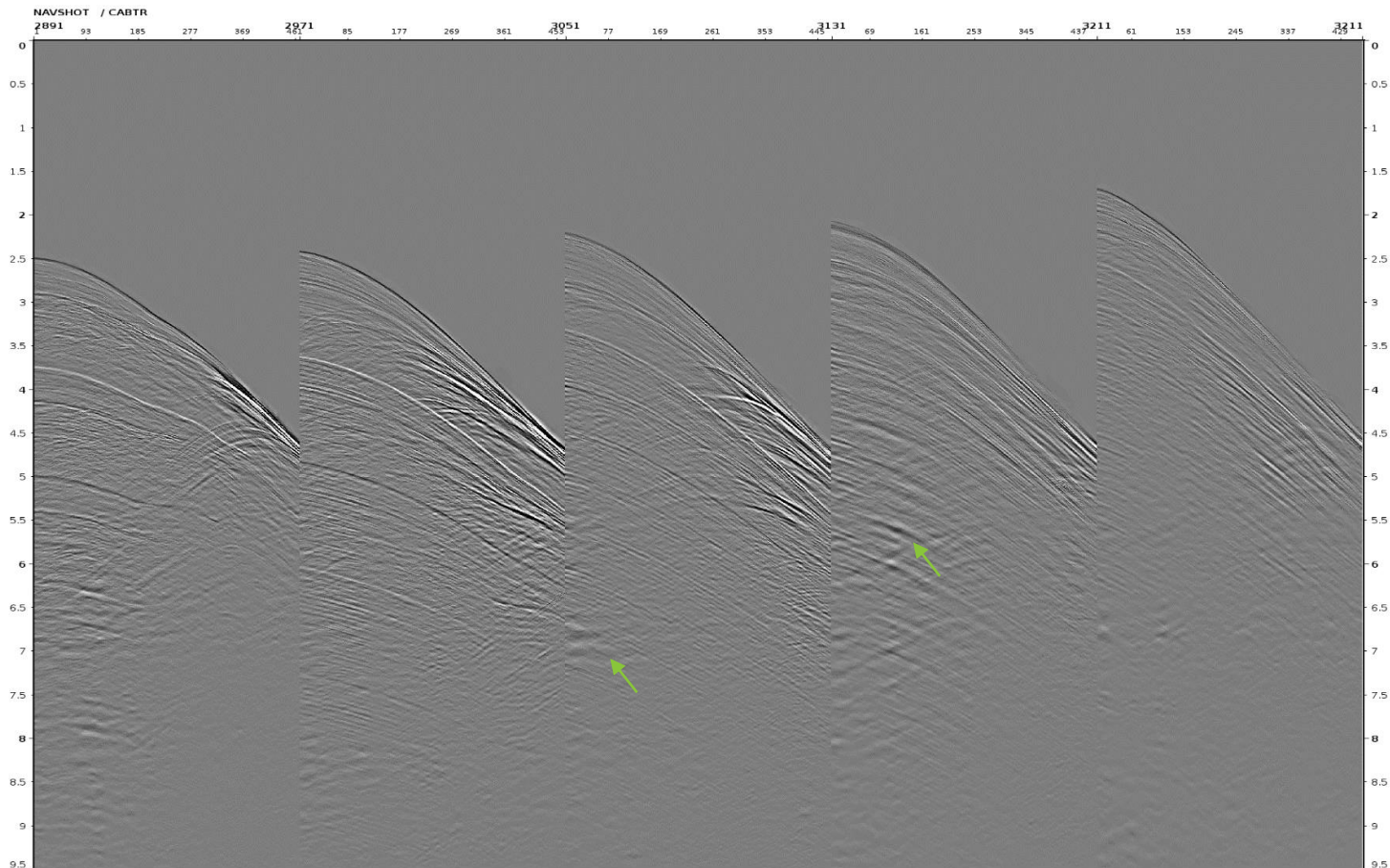


Difference before - after SRME Subtraction

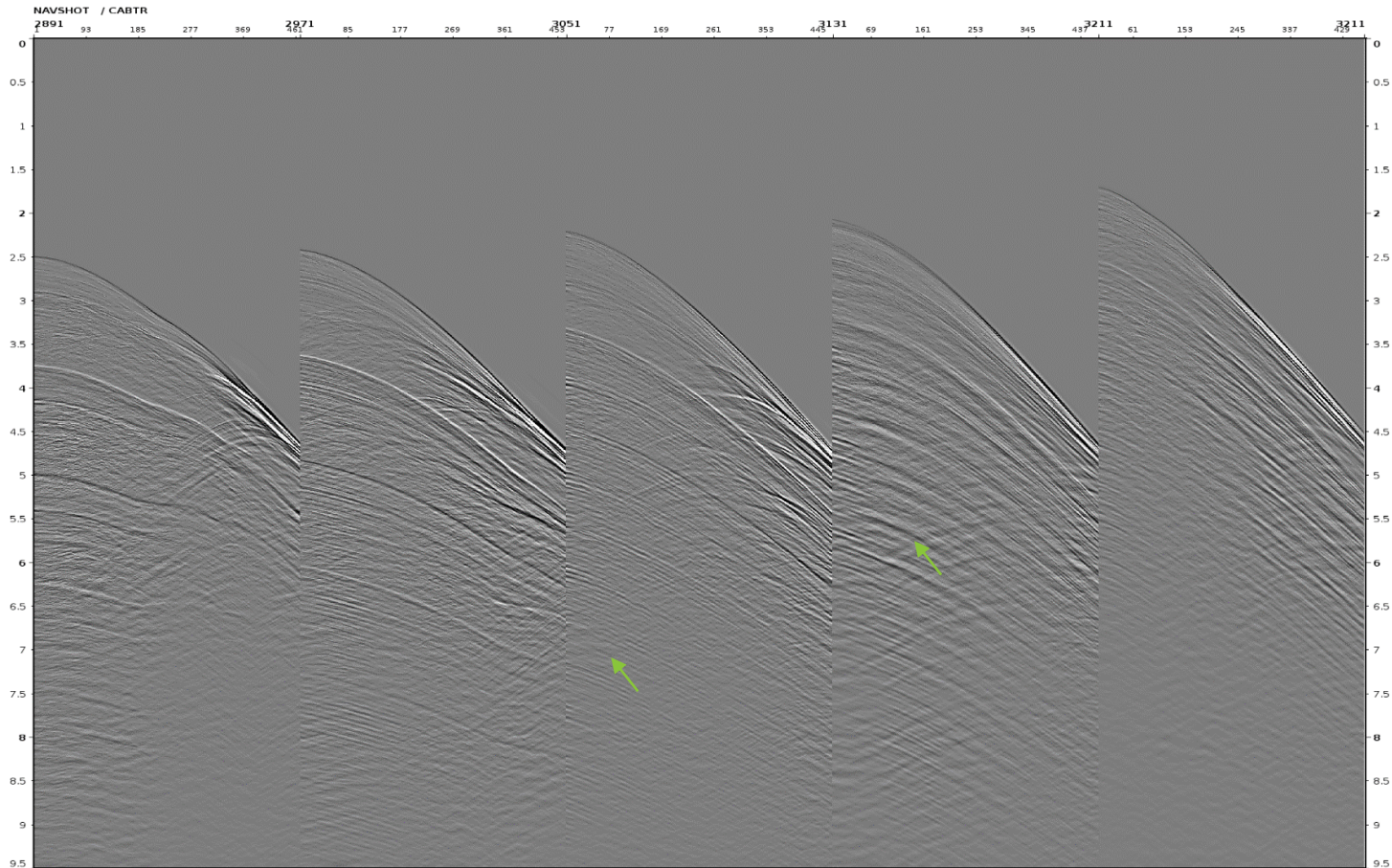
90



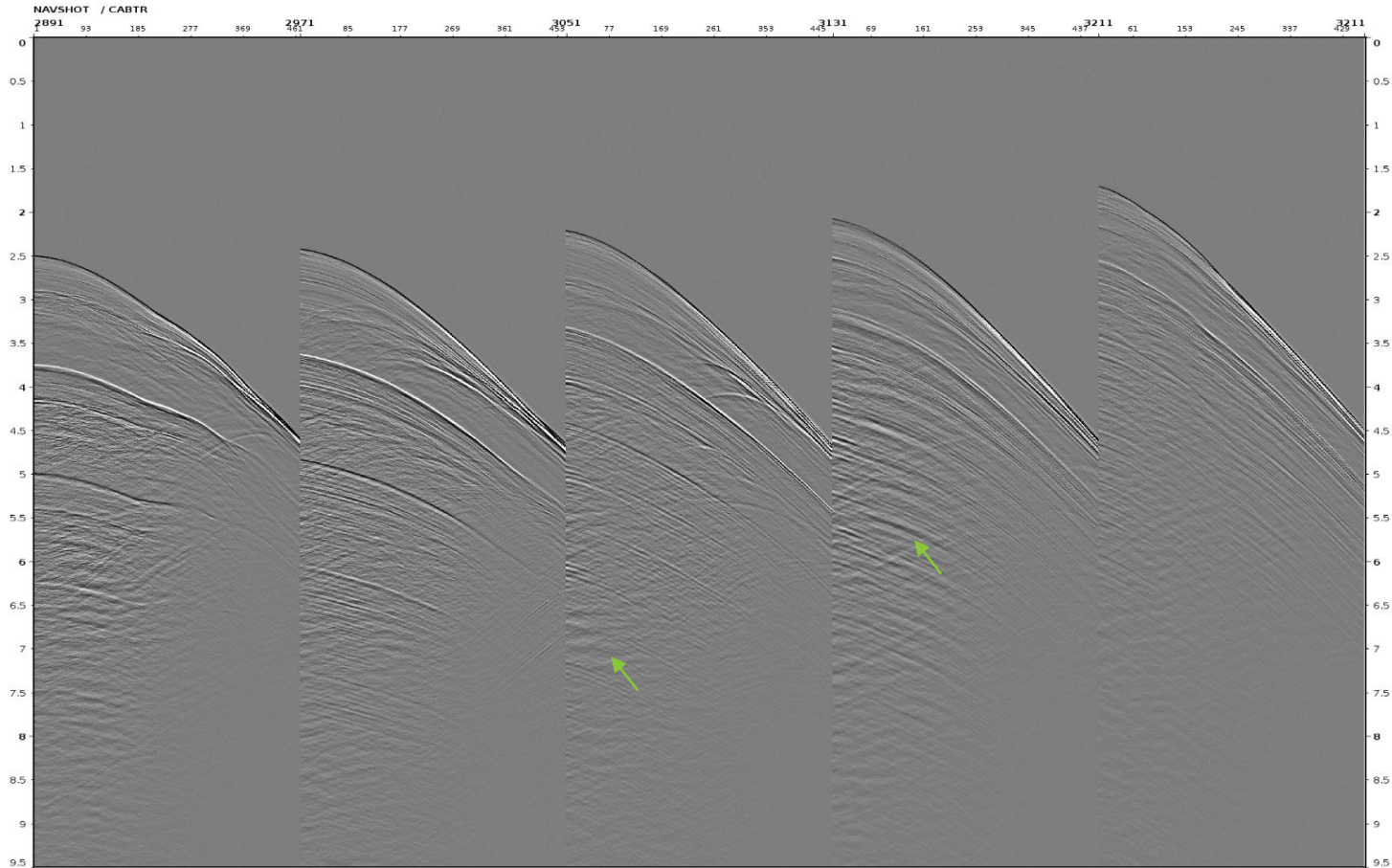
- Simultaneous subtraction flow with MWD & SRME shows benefits in surface related multiples removal and primaries protection.



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- Simultaneous subtraction flow with MWD & SRME shows benefits in surface related multiples removal and primaries protection.

- Simultaneous subtraction is beneficial for multiple removal and primary protection. It's recommended to apply for production.